



## The Virtual Gardener—The Science of Seeds

‘Tis the Season—time for long winter naps and visions of next year’s garden to be dancing in your head. It’s also a time for perusing seed catalogs and beginning to think about starting seeds indoors to get an early start outdoors next spring. This month I want to talk about a fantastic resource for seed starters developed by a scientist most gardeners have never heard of, Dr. Norman Deno.

Dr. Deno was a professor emeritus of chemistry at Pennsylvania State University who late in his career turned his attention to horticulture. He was one of the first researchers to apply the methodology of chemistry to the study of seed germination. He experimented with thousands of different seeds and along the way not only illuminated the processes of germination, but also developed practical techniques for gardeners to use in starting their own seeds. His work is documented in three publications that are available free for download in pdf format from the U.S. Department of Agriculture. The basic

document is [Seed Germination Theory and Practice, Second Edition](#) which comes with a [First](#) and a [Second](#) supplement.

Dr. Deno regarded seed germination as a chemical process initiated by reactions controlled by environmental factors. The processes vary by species and are designed to promote the survival of a species in its native environment by delaying germination until environmental conditions are just right for the survival of the seedlings. For example, the seeds of plants native to cold climates should not germinate immediately in the fall but wait until the weather warms up in the spring. Similarly plants native to regions with wet and dry seasons delay germination to periods when moisture is available. Different plants—sometimes even closely related species—may employ different mechanisms to achieve the same delay in germination. According to Deno, about

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**“I highly recommend Dr. Deno’s book and the supplements.”**

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95 percent of the species he studied used chemical methods to delay germination and only 5 percent used physical methods.

Chemical methods operate by controlling the initiation of complex chemical reactions within the seed and the rates at which those reactions proceed. Temperature, moisture, light, and the external presence of certain plant hormones called gibberellins, especially Gibberellic Acid-3 (GA-3), produced by microorganisms in the soil are the factors most frequently used. Sometimes a single factor controls germination but more frequently a number of different factors operate in combination to produce the desired effects.

The most common physical method is usually called “scarification,” although the method has nothing to do with creating a scar. Dr. Deno abhorred the use of that term and preferred the term “puncturing.” Whichever term is used, the purpose of the technique is to breach the impervious coating of some seeds to allow water and/or oxygen to reach the embryo and initiate the sprouting reactions.

The technical details of how seeds germinate is fascinating and well worth reading, but the practical methods Deno used to sprout seeds along with his extensive lists of the best conditioning and germination techniques to use for different plants will probably be of more interest to many gardeners.

Deno used several methods for germinating seeds, but one of the germination techniques he pioneered was the “baggie and paper towel” method. This was his method of choice for species

with multistep and extended germinations, and he often achieved germination rates above 90 percent using it. To use this method, the seeds are placed on a moistened paper towel enclosed in a polyethylene sandwich bag. The bags are kept in heated or cooled environments according to the needs of the seeds being germinated. Deno used only two temperatures for his experiments—40°F for chilling and 70°F for warming. Some seeds germinate at only one temperature and others require both chilling and warming. His germination reference lists indicate the requirements for hundreds of different species. Once the seeds have sprouted in the paper towels, they are transferred to pots to grow into seedlings.

In addition to heat and moisture, Deno found that treatment of seeds with GA-3 significantly improved his germination rates. Gibberellic acid is a naturally occurring, growth-promoting hormone that is produced by plants and microorganisms. A search of the web will locate a number of sources where this product can be purchased.

Growing plants from seed is a very cost-effective way of populating your garden, especially with landscape plants that are expensive to buy in the nursery. Many landscape plants have produced seeds over the summer that can be harvested now and started over the winter for planting next spring. If you are interested in seed-starting, I highly recommend Dr. Deno’s book and the supplements.

Gary Gruenhagen, Master Gardener  
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## Let's Plant Roses!

**(Editor’s Note:** This article written by Bill Schulze was adapted from a December 2012 article published in the *Sierra Vista Herald*.)

Toward the end of this month and into the first months of the new year, bare-root roses and bare-root fruit trees will be widely available in nurseries. So if roses or fruit trees are something you’ve got a hankering for, keep your eyes open and your shovel handy. When planting bare-root plants, soak the roots of the plant in water for a few hours (no longer than a day or two) prior to planting. Dig a hole two or three times larger than the root ball, but no deeper. Cut off damaged roots and gingerly untangle and spread out the remaining roots. Place the plant in the hole and refill with the native soil you just removed. Water well to eliminate air pockets and do not compact the soil by tamping with your feet. Don’t amend the soil or add fertilizer for the first year, although it is a good idea to remove stones and rocks. Do not plant a tree or shrub deeper than it’s roots require. Planting too deeply exposes the bark of the trunk to rotting. If the plant is grafted, as most roses and fruit trees are, plant so that the bud graft union is two or three inches above the soil line. Keep the soil moist but don’t overwater as water needs are slight while the plant is dormant.

As the holiday season nears, living Christmas trees will be for sale in nurseries. If you buy one and want to plant it, look for a tree that is adapted to our climate. Pine trees that will do well here include the Aleppo Pine (*Pinus halepensis*), the Afghan Pine (*Pinus elderica*), and the Italian Stone Pine (*Pinus pinea*). Both the Aleppo and Afghan pine are fast growing. The slower grow-

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# Ready, Set . . . Grow!

During my undergraduate and graduate studies at New Mexico State University I belonged to a student organization known as the NMSU Hort Forum. One year, we collaboratively worked on a club T-shirt and decided it would be fun to not just display our student club logo on the front, but also include funny or clever quotes that finished the line “You might be a horticulturist if \_\_\_\_\_.” All of us students in the club had the assignment to work on our own list of finished statements and we would bring them back to a meeting and vote on the top ten to include on the back of our shirts.

One of the quotes that made it to the list was, “You might be of horticulturist if . . . you secretly spread wildflower seeds on bare or boring properties.” There was actually a small group of us who got together and did such thing at times, usually under the cover of night in the fall and winter months. You see, we selected seeds that needed the cold stratification of winter but didn’t require supplemental water in order to grow and bloom the following season. The easiest planting ever, all we needed was our carefully selected wildflower seeds, a rigid toothed rake, and seed cover (e.g. sand). It really felt at times like we were performing a black ops mission!

A popular seed choice that was always in the mix were *Penstemon* species. It is such a remarkable flower and can really just handle absolute neglect after established. I have been asked several times by people who have tried to grow this flower and say,

“The seeds just won’t germinate.” Often times they were just watering and giving it too much TLC.

There are more than 250 *Penstemon* species and they are quite diverse in their selection of where to grow. More than twenty cultivars have been given the Award of Garden Merit by the Royal Horticultural Society and here is a link to their website if you are looking for vibrant colors, <https://www.rhs.org.uk>, just search for *Penstemon*. From low deserts to high in the mountains, flat plains, and in the forests, *Penstemon* can be an outstanding addition as one of your selections for wildflower to brighten up un-used or neglected properties. You can shop for some seed from the locals in Tucson at <http://shop.nativeseeds.org/> or from our neighbors in Albuquerque, NM at: <http://www.plantsofthesouthwest.com/>.



These flowers are even more dramatic when inter-mingled in a rock garden or a rocky hillside. *Penstemon* also has an array of other native wildflowers that look outstanding when planted densely together.

If you would like more information on propagating and care of *Penstemon* there is an American *Penstemon* Society website with lots of information. Check it out here: <http://apsdev.org/>.

Since the majority of *Penstemon* flowers are in the reds, pinks, and blues it can be really striking to interplant with yellow and white colors and textures. I would suggest checking the bloom time (some can be early versus late) for the particular *Penstemon* cultivar you are interested in and choosing a similar bloom time with the other wildflowers. It can make quite an impact! Some popular companion plants would be *Coreopsis* species (many colors are out there), Desert Marigold (*Baileya multiradiata*), Velvet Turtleback (*Psathyrotes ramosissima*), Silverpuff (*Uropappus lindleyi*), Greene’s Bird’s-Foot Trefoil (*Acmispon greenei*), some of our Desert Senna (*Senna covesii*), and of course the Desert or Mexican golden poppy (*Eschscholzia glyptosperma* or *E. californica* spp. *Mexicana*). Grasses that would look great along with *Penstemon* and with similar growing conditions could be your Gramas such as those showcased in the October MGNL newsletter (Sideoats grama or Blue grama) and/or Muhly grass (*Muhlenbergia lindheimeri*). You may be able to come up with even better, more striking companions.

So, planting season isn’t over yet! We still have time to plant wildflowers (and bare root cane and fruit trees) out there and add some color to an otherwise drab corner lot, roadside, or path for next year. Happy planting, friends!

Joshua Sherman, M.S.  
Commercial Horticulture Area Agent



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ing Italian Stone Pine is the variety from which pine nuts (seeds, really), popular in Italian cooking, are obtained, so this tree does double duty. Be patient, though, it can take ten or more years to yield the pine cones from which the tasty nuts are obtained. When planting a living Christmas tree, just remove the tree from its pot and place it in a hole that is two or three times the diameter of the pot, then refill the hole with unimproved native soil as above for bare root trees. Again, don't plant too deeply. Maintain the same soil level that the tree had in its pot.

Happy gardening!

*Bill Schulze, Master Gardener*

## Cuttings 'N' Clippings

✿ Follow the Cochise County Master Gardeners at:

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

For more information contact Valerie at:

[valeriedavidson@email.arizona.edu](mailto:valeriedavidson@email.arizona.edu)

You can also follow them on Facebook at: [www.Facebook.com/CochiseCountyMasterGardeners](http://www.Facebook.com/CochiseCountyMasterGardeners)

✿ The Master Gardeners are at the Sierra Vista Farmers Market on the **first Thursday of each month.**

✿ Check out the Water Wise web site to see what's happening at: [waterwise.Arizona.edu](http://waterwise.Arizona.edu)

✿ The Cochise Chapter of the Arizona Native Plant Society holds monthly programs in the Cochise County Community Development Office Conference Room, 4001 Foothills Dr. (corner of Highway 92 and Foothills), Sierra Vista at 5:00 PM. The Chapter has established a Facebook website at:

<http://www.facebook.com/AZNPSCochise>.



## Become a Master Gardener . . . Recruiting for 2016 Class

Would you like to become a Master Gardener? Are you interested in becoming more knowledgeable by receiving university level training in horticulture? Do you have the passion, the commitment, and the willingness to serve your community by providing a minimum of 50 hours of volunteer service each year? Are you willing to assist Cooperative Extension by providing educational information to the community in home gardening and landscaping? If you can answer yes to these questions, we would love to have you join our ranks.

Applicants should want to learn more about gardening in the high desert, enjoy meeting others with similar gardening interests, enjoy sharing knowledge with others in your community, and have time to meet the volunteer and continuing education requirements. Submitted applications must be post-marked by **December 15th**. A maximum of 25 applicants can be accepted due to space limitations and are considered in the order they are received. The course fee is a cost recovery fee, and is dependent on the projected costs of materials, so it varies from year to year.

The **16 week training course**, delivered by University of Arizona Cooperative Extension faculty and specialists begins **Wednesday January 20 from 10:00 AM—1:00 PM** and runs every Wednesday through May 11.

For more information please visit our web site or contact Jan Groth, Coordinator: Cooperative Extension, UA Sierra Vista, 1140 N. Colombo, Sierra Vista, Arizona 85635-2390, Tel: (520) 458-8278 ext 2176 or: [jangroth@email.arizona.edu](mailto:jangroth@email.arizona.edu)

## Gratitude Revealed – A Book Review

No, this isn't a new gardening book! It is, in fact, "a tribute to women with undaunting commitment & humility" by Pauline Fredericks with Heather Bird, both local photographers. In this newly published book, the author has photographed women from all walks of life who are inspirational with a selfless commitment to Sierra Vista/Cochise County. So why a book review in this newsletter?

Three women from the UA Cooperative Extension in Sierra Vista are honored in the book among the 115 women. They are Cado Daily, Water Wise Program Coordinator, Jan Groth, Master Gardener Program Coordinator, and Carolyn Gruenhagen, Master Gardener and this newsletter editor. Each of these three have been involved with the Cooperative Extension more than twenty years. Congratulations ladies!

The beautiful limited edition book is available at:

<http://pfredericksphoto.com/store/gratitude-revealed-book>

*Gary Gruenhagen, Master Gardener*

## At a Glance Box

### It's a Bloomin' Cochise County Native Plant of the Month

**Plant:** Palmleaf thoroughwort, Gregg's mistflower, *Conoclinium dissectum* or *Conoclinium greggii*

**Description:** 1-2' high, perennial. Deciduous in non-tropical climates.

**Blooms:** Purplish flowers monsoon through fall.

**Use:** Pollinator habitat garden; natural garden.

**Culture:** Spreads by rhizomes; partial shade; USDA hardiness zones 7-10.

**Learn more:** Cochise County Herbarium

[www.cochisecountyherbarium.org](http://www.cochisecountyherbarium.org); Integrated Taxonomic Information System ([www.ITIS.gov](http://www.ITIS.gov)); Southwest Environmental Information Network (<http://swbiodiversity.org/seinet>)

For an in-depth article, see below.

Karen LeMay, Guest Author, Founder of Pollinator Corridors Southwest  
[www.PoCoSouthwest.org](http://www.PoCoSouthwest.org)

the Portal area.

It is fortunate for gardeners that this plant is readily available in the nursery trade. Note that nurseries may not be using the most current common or scientific name for the plant, so be sure to include all synonyms when searching or asking for this plant. Desert Survivors in Tucson lists this plant under *Conoclinium greggii* and notes it is an "incredible nectar source for butterflies & pollinators." See all of their plant lists at:

<http://www.desertsurvivors.org/plant-lists.html>.

In the Lower Rio Grande Valley of south Texas, the similar species Betonyleaf thoroughwort, is used in mass plantings in public and private butterfly gardens where they attract as many as 50 species of butterflies. Imagine being surrounded by a sea of violet blossoms covered by hundreds of butterflies fluttering around—it's quite an experience!



Betonyleaf thoroughwort  
native to South Texas

All mistflowers spread by underground tight clumps of rhizomes that grow in several types of soils including sand, loam, clay, and limestone. But keep in mind it does require medium supplemental water to keep the plant in full bloom, as is the case with most long-blooming

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### CORRECTION:

The first sentence of the second paragraph on Page 5 of the November Newsletter should have read—Flowers in the spurge family are unisexual on either the same or different plants.

### Palmleaf thoroughwort, Gregg's mistflower

Look on any list of plants for butterfly gardens, and you will find a recommendation for mistflower. There are three species of mistflowers in the United States. Palmleaf thoroughwort is the only species native to Cochise County.



Palmleaf thoroughwort

I imagine you're thinking, "Isn't that a picture of Gregg's mistflower or Eupatorium or Boneset?" As I discovered in researching this plant, the scientific and common names have changed many times. The Integrated Taxonomic Information System ([www.ITIS.gov](http://www.ITIS.gov)), the source for standardized common and scientific plant names, has declared Palmleaf thoroughwort to be the accepted common name, and Gregg's mistflower or Eupatorium as synonyms. ITIS has declared *Conoclinium dissectum* to be the accepted scientific name, with *Conoclinium greggii* and *Eupatorium greggii* its synonyms.

Palmleaf thoroughwort is native to Arizona, New Mexico, and Texas, growing in Chihuahuan Desert grassland and dry stream bed habitat. There are several records of this plant in Cochise County shown on the Arizona Flora SEINet maps (<http://swbiodiversity.org/seinet>). I've been told the plant grows naturally in the Upper San Pedro River floodplain and I've seen lush plants with several visiting butterflies in

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*(Spurges continued from page 5)*

plants for butterfly gardens. Also remember that deer and small mammals find the plant yummy; you may want to enclose it behind a fence.

The most interesting information I found about mistflower is why it's so attractive to butterflies and other pollinators. I had assumed the flower attraction was due to a high concentration of sugar-rich nectar, but it turns out



**Ctenucha moth on Palmleaf thoroughwort**

there are other substances in the nectar that are especially valuable to some insects. One of these compounds is an alkaloid prized by some male insects for production of pheromones to attract females. I have seen several Queen butterflies at one time on mistflower plants in my garden, and they were mostly males. I've noticed many of the beautiful Ctenucha (pronounced ten-OOCH'-a) moths preferring mistflower, when there were many other flowers to visit.

Another insect attracted to mistflower is the outrageous Panther-spotted grasshopper. Although gardeners may not want to attract plant predators, it is well worth losing a few leaves to this beautiful visitor.

With this knowledge, it makes sense to include as many native plants as possible in a habitat garden. Native plants and their pollinators evolved together, and the

plants supply the insect with nutritional essentials that the gardener may not be aware of.

*Karen LeMay, Guest Author, Founder of Pollinator Corridors Southwest (a new nonprofit supporting native plant habitats and their pollinators)*

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

*Plant images by Karen LeMay*

*Insect images and technical advice from Robert A. Behrstock*



**Panther-spotted grasshoppers are very fond of mistflower**



**A locally uncommon Toltec Roadside-Skipper**



**A Cuckoo Bee feeds on mistflower**



**Painted Crescent butterfly and Soldier beetle**

*Thanks Bob for the beautiful photos!*

Cochise County Master Gardener Newsletter Editor  
Carolyn Gruenhagen