**2018 WERA-1013 annual report**

**Accomplishments**:

Overall, the WERA-1013 group has made good progress in identifying, selecting, evaluating, and marketing selected native plants deemed of ornamental interest and of value to landscape water conservation and pollinator protection efforts. Our research focus has been on evaluation and selection, whereas our extension focus has been on educating the public and the nursery industry and on marketing selected species to various stakeholder groups. One of those groups, the nursery and landscape industry, is of key interest to many of our members, and we have made great strides in technology transfer of hundreds of species to industry groups in our respective states. Collaborative efforts revolve around sharing plant materials for evaluation and on creating educational materials that will help to get the message to stakeholders about the water-conserving and pollinator-protection aspects of the plants we select. Our plans for the coming year are to continue sharing and evaluating a diversity of native plant taxa across our region and to develop a more robust and dynamic interaction with the public by inserting interactive materials on a garden blog site managed by WERA-1013 member, Linda Chalker-Scott.

In 2018, twenty-nine new species accessions were collected by WERA-1013 member Stephen Love as seed or stem cuttings from the Owyhee Range in southwestern Idaho, and transported back to the Aberdeen R & E Center for processing and grow-out.

Horticultural performance was evaluated on accessions established over the past 13 years in a 3-acre field on the Aberdeen R & E Center. Plots were exposed to environmental factors designed to allow selection of adapted, drought-tolerant species. The evaluation plots are located on a site with moderately heavy silt-loam soil with high pH (8.2). Drought stress was imposed by limiting irrigation with seasonal water applications comprised of 25 to 30% of the annual reference evapotranspiration rate for SE Idaho. In a typical year, this equals about 6 inches of supplemental (above natural precipitation) water applied annually to the plots over the period June to August. During the growing season, plot-by-plot and sometimes plant-by-plant observations were recorded describing hardiness, soil and climate adaptation, mature appearance, flower color, bloom period, plant longevity, pest issues, and general horticultural value.

Native plant species with superior adaptation and horticultural performance were identified and retained for future evaluation. Inferior species/accessions were systematcally rogued and eliminated from the evaluation plots. At the end of the 2018, the number of superior accessions retained for on-going evaluation numbered approximately 540. These exceptional plants comprise a selection pool for developing new and improved native plant nursery products.

Seed was collected from superior native species in the evaluation plots, then propagated and established in a seed increase block in the spring of 2018. Seeds harvested during the summer months from the increase blocks were used to further propagate desirable species in preparation for transfer to our Native Roots, LLC industry partner.

In the spring of 2018, 13 native plant species with market potential were legally transferred to Native Roots, LLC for establishment within their commercial-scale seed increase fields. In preparation for tranfer, transplants were propagated at the Aberdeen R & E Center and shipped to Native Roots, LLC in Filer, Idaho. Transferred species included: lilac beardtongue (Penstemon gracilis), Mojave beardtongue (Penstemon incertus), sulpur-flower buckwheat (Eriogonum umbellatum var. umbellatum), Pennyroyal (Monardella odoratissima), king’s crown (Rhodiola integrifolia), little bluestem (Schizachyrium scoparium), Indian grass (Sorghastrum nutans), side-oats grama (Bouteloua curtipendula), syringa (Philadelphus lewisii), bush cinquefoil (Dasiphora fruticosa), Illinois bundleflower (Desmanthus illinoisensis), smooth sumac (Rhus glabra), and fragrant ash (Fraxinus cuspidata var. macropetala).

Native Roots, LLC this year announced the release of five new native plant products. These plants have been added to the existing inventory, made up of 47 plants that are currently being advertised and wholesaled. Descriptions of the five new native plant products, as included in publicity distributed documents are given below:

Bubblegum mint (Agastache cana)

A relatively tall, stately perennial with a bloom period timed appropriately to add color to late summer and early fall. Long spikes of fuchsia-colored flowers rise above attractive foliage. The Native RootsTM version of this species is robust and provides a long season of color during what is normally a drab period in a native landscape.

Harebell bellflower (Campanula rotundifolia)

A favored species among wildflower connoisseurs, this diminutive plant adds a long season of interest to any bed or border. The Native RootsTM version of this species is compact, floriferous, has a very long bloom period, and partially self-cleans after bloom.

Owl’s claws (Helenium hoopesii)

Plants are moderately tall when in bloom and have wide, fleshy, strap-like leaves. Flowers are very large, orange-yellow sunflowers. The Native RootsTM selection of this species is robust with extra-large flower heads.

Sandia Mountain alumroot (Heuchera pulchella)

Sandia Mountain alumroot rivals the best of the hybrid cultivars of this beautiful and diverse species. A compact mound of round, toothed leaves are topped in early summer by dense, bright pink spikes of flowers. The Native RootsTM version of this species has very compact habit and dark pink flowers.

Venus penstemon (Penstemon venustus)

Part of a genus of remarkably beautiful plants, venus penstemon is one of the best. Native to the region around Hells Canyon, this species puts on a spectacular display in nature for about six weeks in spring. Flowers are dark purplish-pink, trumpet-shaped, and borne in long spikes. Foliage remains attractive summer-long and contributes to appeal after the bloom is gone. The Native RootsTM version of this species has good adaptation to calcareous soils.

Plant Select® is a program began by WERA-1013 member, James Klett, with the goal to create smart plant choices for a New American Landscape inspired by the Rocky Mountain Region. It is the country’s leading source of plants designed to thrive in the high plains and intermountain region; a non-profit collaboration between Colorado State University, Denver Botanic Gardens and horticulturists around world.

In 2018, Plant Select® introduced two plants and promoted six additional plants. A clonal selection of Scutellaria scordifolia ‘Pat Hayward’ (Sky’s Edge™ scutellaria) was introduced due to its intense violet-blue flowers, hardiness, long period of bloom and season-long glossy green foliage. The other introduction Delosperma Granita™ (Granita™ Raspberry Ice plant) is a vigorous and floriferous plant with large, striking, iridescent raspberry flowers that are densely packed. It creates a beautiful, shiny, dark pink carpet at the front of a border or woven throughout a bed under planting taller perennial and shrubs.

Six additional Plant Select® Plants were promoted in 2017-18 including: Digitalis thapsi (Spanish Peaks® foxglove) which blooms in early summer with tubular raspberry flowers and a strong perennial; Echinacae Tennessenis (Tennessee purple cone flower) which is an American native which is remarkably adaptable to steppe regions of intermountain west with pink blooms from late spring to early summer; Seseli gunmiferum (Moon carrot) which boasts silvery-blue rosettes in the first season of growth and second season large unusual flat umbels of pink flowers that transform into globes or clusters; Calamagrostis brachytricha (Korean feather reed grass) which has light green foliage and vertical structure with soft pink flowers in late summer with yellow fall color and good winter interest; Philadelphus lewisii ‘PWY01S’ (Cheyenne® mock orange) which is a western United States native which is an upright shrub that produces clusters of pure white and fragrant flowers in early summer; and Geranuim dalmaticum (Dalmation pink cranebell) which is a petite plant with pink flowers in spring to early summer and attractive foliage during growing season turning reddish in autumn.

Numerous plants that were collected on Plant Select® sponsored trips to Kazakhstan and Argentina continued to be evaluated at Denver Botanical Gardens, Chatfield. Several have been chosen for introduction in future years after stock is built up to meet market demand.

In 2018, greenhouse experiments continued on two Plant Select® taxa (Heuchera saiguinea ‘Snow Angel’ and Zauschneria gariettii ‘Orange Carpet’. Two additional taxa were added in 2018 including Salvia pachyphylla and Osteospermum ‘Avalanche’. Three different container sizes and either three or four different growing media were researched. Experiments with Heuchera and Zauschneria were repeated in 2018. There was no advantage of using larger containers based on number of cuttings obtained per square feet. Also, container size doesn’t seem to affect fresh weight of cuttings significantly nor health or vigor of plants. Rooting studies have shown exceptional high percentage of rooting with Heuchera and to a lesser extent with Zauschneria. Plant Growth Regulator Studies with the same taxa discussed above were also conducted in 2018. Results from this study showed an increase in number of cuttings but no difference in fresh or dry weights per stock plant or per individual cuttings. With Heuchera saiguinea ‘Snow Angel’ PGR fascination at 50 ppm was observed to promote the most vegetative growth. With Zauschneria gariettii PGR fascination at 50 and 100 ppm resulted in the most cuttings, but lower quality of cuttings. Configure at 250 ppm resulted in more cuttings and maintained good quality. The PGR study with Salvia pachyphylla (first study) resulted in a significant difference in fresh weight and dry weight per individual cutting, but no significance in the number of cuttings or fresh weight and dry weight per stock plant. Fascination application at any rate will increase the number of Salvia pachyphylla cuttings available on a stock plant. A fertilizer study was also conducted with the same plant taxa. During the winter (December – March) stock plants of Heuchera sanguinea fertilized with Plant Marvel 18-6-18 at 200 ppm resulted in the greatest number of harvested cuttings. During the summer months (September to November) Heuchera sanguinea stock plants fertilized with Grow More 20-10-20 at 200 ppm resulted in the greatest number of harvested cuttings. Similar results were found with Zauschneria garrettii ‘PWWG01S’, and with Salvia pachyphylla. Also in 2018, three woody plants were planted at four research sites throughout Colorado including a hardy clone of Thuja (Arborvitae) and of Morus (mulberry) and Carya (pecan). Two Cercocarpus introductions from Utah State University are being investigated, which we received in 2016 and 2017. The 2016 introduction of Cercocarpus ledifolius has established well at most sites and looks to be a promising new form of Cercocarpus.

The Texas group, headed by Genhua Niu and Mengmeng Gu, evaluated the salt tolerance of the following perennials: Evolvulus Blue Daze (Evolvulus glomeratus), Veronica Sunny Border Blue, Sedum Angelina, Sedum Autumn Joy, Sedum Blue Spruce, Rudbeckia Indian Summer. Data are being analyzed. Rooted cuttings were transplanted to one gallon containers and irrigated with nutrient solution (control) or saline solutions at electrical conductivity (EC) of 5 or 10 dS/m. Different species and cultivars responded differently to saline solution irrigation. We are currently analyzing the results. They also evaluated the following woody ornamental species: Itea virginica ‘Scentlandia’ , Juniperus communis ‘Gold Cone’, Loropetalum chinense ‘Jazz Hands Bold’, Ilex glabra ‘Shamrock’, Ilex verticillata ‘Berry Poppins’, Ilex x meserveae ‘Castle Spire’, Aronia melanocarpa ‘Low Scape Hedger’, xPyracomeles ‘Juke Box’.

In addition to the above studies, the Texas group has conducted field cultivar evaluation of pomegranate, which is a promising new fruit tree but also it is an excellent landscape woody shrub or small tree with attractive flowers in the spring and high tolerance to abiotic stresses such as salt and drought stresses. Our goal is to identify cultivars that have high resistance to sunburn, fruit split and diseases.

Another focus in Texas in on strategies to manage an exotic pest (crapemyrtle bark scale) threatening the aesthetics and landscape use of the No. 1 flowering tree in the U.S., crapemyrtle. One focus of the project is to confirm the alternative hosts listed in literature (see Table 1 below). We published an extension publication (Gu, M. 2018 Alternative hosts of crapemyrtle bark scale. 5/18. Texas A&M AgriLife Extension Service EHT-103). In addition to 29 commonly grown Lagerstroemia indica and L. fauriei cultivars, infesta­tion of CMBS has been found on 4 crapemyrtle species (Lagerstroemia limii, L. speciosa, L. sub­costata, and L. guilinensis). CMBS was also confirmed on five beauty­berry species (Callicarpa americana, C. formosana, C. ruebella, C. mexicana and C. dichotoma), pomegranate (Punica granatum), henna (Lawsonia inermis), heimia (Heimia salicifolia), and winged loosestrife (Lithrum alatum), under controlled environment. Additional species are under investigation: Buxus sp., Celtis sinensis, Anogeissus latifolia, Diospyros kaki, Mallotus japonicus, Dalbergia eremicola, Glycine max, Lagerstoemia, indica speciosa, Punica granatum, Ficus carica, Myrtus sp., Ligustrum obtusifolium, Ternstroemia japonica, Glochidion, puberum, Malus pumila, Rubus sp. and Callicarpa sp.

WERA-1013 member, Heidi Kratsch from Nevada, has focused on aiding in collection of propagation materials for other states and evaluation of many native species for their drought tolerance. This year, we added a pollinator protection aspect to our activities. We have planted a total of 7 native plant pollinator gardens across Nevada. Three are Cooperative Extension sites: Washoe County Cooperative Extension West Side Garden, Joule St. Master Gardener Training & Demonstration Raised Bed Garden (Reno), and the Lost City Museum in Overton, NV (managed by Master Gardeners). The other 4 sites include: Jacobs Family Berry Farm (agricultural site) in Gardnerville, NV; Walker Basin Conservancy in Walker River, NV; Montara Estates (Homeowner’s Association) in Las Vegas, NV; and the Elko Garden Club in Elko, NV. Siting these plots in diverse climates and garden types across the state allows us to not only evaluate the plants for their pollinator-protection value, but it also enables us to determine the adaptability of the selected species to various microclimates and uses. The selected species include: Agastache urticifolia, Stanleya pinnata, Sphaeralcea ambigua, Penstemon eatonii, Penstemon speciosus, Eriogonum umbellatum, Oenothera caespitosa, Baileya multiradiata, Aster engelmannii, Gilia aggregata, and Hesperostipa comata.

WERA-1013 member, Larry Rupp from Utah, has identified superior cone-producing accessions of *Pinus monophylla* from four pinyon pine groves in the Great Basin (Austin, Nevada; Hamlin Valley, Utah; Eureka, Utah; and Raft River Mountains, Utah). Trees were selected based on their location in areas of historical pine nut collection, current level of cones on trees, cone windfalls under trees, and quantification of cone scars on branches. Cone formation on pines leaves a scar on the branch that persists for several years and enables an estimation of tree productivity. A total of three trees from each of the four groves were selected.

A number of grafting techniques were evaluated for the purpose of topworking existing *P. edulis* trees to superior selections of *P. monophylla*. The greatest success was obtained by grafting *P. monophylla* scions from Eureka, Utah to unirrigated *P. edulis* at the Blue Creek Experimental Farm in Pocatello Valley, Utah. Grafting was done in April of 2018 with either side-wedge or side-veneer grafts. All scions had needles present and the grafts were wrapped in clear plastic and covered with opaque, 6-mil white plastic. Results to date indicate 83% of side-veneer grafts were successful and 82% of side-wedge grafts were successful. These results are preliminary because we won’t be able to fully assess grafting performance until graft performance is assessed the year following grafting. But, these grafts went on to break bud and produce new growth which is a positive indication of success. A success rate of 80% proves that this is potentially a viable option for topworking to superior accessions. Final assessment will not be determined until next spring when we see how the trees overwintered.

A further goal of the study is to establish an orchard of superior *P. monophylla* accessions by grafting selected scions onto *P. edulis* seedling rootstocks. In the fall of 2017 we obtained seedling rootstocks that were held in a coldframe until grafted in late winter of 2018. A total of 288 trees were grafted with 12 different scion accessions. Trees were grafted with either side-wedge or side-veneer grafts and held under a high humidity and shade for 6 weeks to heal. After the grafts were healed, trees were moved to a heated greenhouse and grown on. After 9 weeks, 92% of the grafts were alive and 77% had produced significant needle growth. There was no significant difference between side-wedge and side-veneer grafting techniques. After 16 weeks, 95% of side-wedge grafts were alive and 89% of side-veneer.

**Short-term Outcomes**:

The major projected outcome for the Idaho native plant research/education project is development of new and improved native plant products for potential use by the western U.S. landscape nursery industry. Thirteen evaluated accessions were delivered to Native Roots, LLC in spring of 2018, bringing the total number of product transfers to 176. Five new native plant products were released for sale, bringing the total number of developed market-available products to 47. Native Roots, LLC continues to create partnerships with production, wholesale, and retail nurseries in several Rocky Mountain states. Greater consumer and general public understanding of the value of native plant and water-conserving landscaping is a second emphasis of the Idaho program. Educational information is delivered through web sites, workshops, and conferences. As a result, citizens of Idaho and the greater western U.S. have a greater awareness of the value of drought-tolerant native plants. Success of this information is demonstrated through increasing demand for native plants in the retail business.

In Colorado, more than 2.26 million Plant Select® plants were sold and grown from grower members of Plant Select®, with many growers located in the Rocky Mountain and Intermountain Region. This shows a continued growth over the six-year period of the project from 1.7 million sold in 2012. These plants were purchased by many garden centers, landscape contractors, landscape management personnel throughout the WERA 1013 region and many homeowners resulting in more satisfied gardeners. There are also Plant Select® demonstration gardens throughout all of Colorado and in many parts of Idaho, Montana, Utah and Wyoming reporting back to Plant Select® on performance of these plants in many areas in the WERA region. Public education continued to be a major emphasis in 2018. Many tours lead by Plant Select® cooperators at demonstration gardens were held at most of these gardens in 2018. Most included educational programs about more adaptable native plants for the public.

The Texas crapemyrtle bark scale (CMBS) team has made significant progress in leading the national multi-disciplinary effort on research and outreach. Over 60,000 page views were reported from 20 blogs posting of CMBS related information,  [<http://citybugs.tamu.edu/2010/05/10/scale/>](http://citybugs.tamu.edu/)  (the most popular post on citybugs.tamu.edu, with 59,000 page views),  [http://insectsinthecity.blogspot.com](http://insectsinthecity.blogspot.com/) (1,016 CMBS page views) and [https://greenviion.wordpress.com](https://greenviion.wordpress.com/) (10,272 views from 4,840 visitors), and <http://sixleggedaggie.com>. 44,540 readers were reached through 28 articles in state and national industry newsletters; 10,824 reached through 129 face-to-face presentations. 14,510 reaches and 121 social postings (e.g. Facebook, Instagram, and Twitter). Over 7,000 reached by 11 YouTube videos. 930 (estimate) reached by 23 presentations at academic conferences hosted by American Society for Horticultural Sciences, Entomological Society of America, and International Plant Propagators’ Society; 2 workshops (‘All about crapemyrtle’; a total 320 contact hours) held in conjunction with TNLA Nursery/Landscape EXPO in 2016 and 2017.

The Utah group has established a proof of concept that desirable pinyon pine nut producing trees can be successfully grafted to existing trees in an unirrigated environment with the goal of improving pine nut production.

**Outputs**:

The most significant output from Idaho is the development of drought tolerant plant materials, distributed via a partnership agreement with the Native Roots, LLC. Other outputs include extension programming, including a web presence and personal contributions to workshops and conferences aimed at education on topics related to water-conserving landscape practices.

Besides recommending and introducing some native and drought tolerant Colorado Plant Select® plants which are quite adaptable to Rocky Mountain and Intermountain Region and beyond, promotional brochures introducing 2018 Plant Select® plants were produced. Other outputs include our increased web presence and online monthly newsletter for supporters which increased in 2018 along with great increase in viewing of our YouTube videos. Our marketing program explains that Plant Select® helps one plant smarter and is a smart collaborative model. The program has an eight-point selection process, which features beautiful, adaptable, water wise plants which result in less work and less import and more stunning successful gardens.

Linda Chalker-Scott, WERA-1013 member from Washington published a book on native plant gardening for the general public: Gardening with Native Plants of the Pacific Northwest by Arthur R. Kruckeberg and Linda Chalker-Scott.

**Activities**:

Research activities in Idaho involve native plant domestication using methods developed specifically for this purpose: collection from wild populations, field establishment, evaluation, selection, and improvement using bulk selection. Extension activities include demonstration of native plant efficacy in public gardens and instruction for professionals and the general public on topics related to native plant landscaping and water-conserving landscape design.

In 2018, The Colorado Plant Select® program celebrated its 21st anniversary and held a conference inviting all of our members and cooperators, demonstration garden personnel and interested industry personnel for an educational program in June with an overall theme that many Plant Select® plants are great pollinators. Presentations were also given at the 2018 Pro Green Conference, 2017 Rocky Mountain Turf Conference in Denver, Colorado and at Colorado Garden and Home Show. Plant Select® plants were also displayed in an educational garden at Colorado Garden and Home Show. Presentations about Plant Select® and more adaptable plants were given at Colorado Native Plant Conference and many other conferences throughout Colorado, New Mexico and Wyoming.

Activities in Utah include selecting and propagating superior accessions of *Pinus monophylla* to mature *Pinus edulis* trees and seedlings.

**Milestones**:

The most critical milestone for the Idaho native plant domestication project is delivery of potentially valuable and publicly acceptable plant products. A sequential step in this process was completed in 2018. A secondary milestone is effective delivery of native plant utilization information through the use of annual field days, demonstration gardens, instructional publications, workshops and conferences, and a web presence, including detailed native plant descriptions posted on the WERA-1013 website. From Colorado, their second book entitled “Pretty Tough Plants” which was published in April 2017 sold out the first printing and now in its second printing. Our executive director has opened new avenues of communications with many nurseries and botanic gardens throughout the Rocky Mountain and Intermountain area. Key milestones from Utah include successfully quantifying pine cone production in wild *Pinus monophylla* trees and successfully grafting scions of those trees to mature, unirrigated *Pinus edulis* trees.

**Impact Statements**:

The ultimate impact of the Idaho native plant domestication project will be water conservation through public acceptance of adapted, drought-tolerant plants and water-conserving landscape practices.

In 2018, a lot of planning was done on the direction Colorado Plant Select® will be taking for next five years. During 2018 we saw an increase in sales of many of our more xeric and native plants especially pollinators. However, the overall greatest impact is the water conservation by planting these plants and the practice of more sustainable landscaping utilizing Plant Select® introductions and recommended plants.

Native plants and adapted species continue to be popular among Texas homeowner and landscapers. Using these native plants will certainly conserve water and be more tolerant to drought and salinity. Information on salt tolerance of landscape will facilitate the use of non-potable water for landscape irrigation.

The long-term impact of work in Utah is to determine the potential for producing pinyon pine nuts as a low-input, sustainable orchard crop. In an era of climate change, increasing drought, and forest fires, the future of wild-collected pine nuts as an industry is unclear. This work is exploring the potential to convert existing pinyons to accessions with better genetics and potential for nut production on marginal lands that are largely suitable only for grazing. This use would be compatible with grazing and could provide diversity in use of these lands. The work is also exploring the potential of pinyons as a cultivated crop with attention being paid to the time period required for trees to come into production, and the effect of supplemental resources such as irrigation and fertilizers on nut production.

**Publications**:

Alosaimi AA, Tripepi RR, Love SL. 2018. Micropropagation of Epilobium canum garrettii (Firechalice) by axillary shoot culture. Hortscience 53(1):62-66.

Cho, KC, DU Jeong, YJ Byeon, M. Gu, TH Han, GC Koh, IT Hwang, GY Ki, HK Kim, BS Kim, SK Jung and HS Choi. 2018. Growth and flowering cut chrysanthemum as affected by source and time of light-emitting diodes. Philipp Ag. Sci. 101:28-35.

Erfan, V, M. Merchant, X. Cai\* and M. Gu. 2018. Phenology and natural enemies of a new scale pest, Acanthococcus (=Eriococcus) Lagerstroemiae Kuwana (Sternorrhynca: Ericoccidae) of crapemyrtles in Texas. Journal of Environmental Horticulture (In revision).

Greyvenstein, O., B. Pemberton, G. Niu, T. Starman and D. Byrne. 2018. Heat tolerance in garden roses. Acta Horticulturae (Accepted).

M. Gu. 2018. Grant final report: Integrated Pest Management Strategies for Crape Myrtle Bark Scale, A New Exotic Pest. USDA NIFA.

M. Gu. 2018. Manage crape myrtle bark scale, an exotic pest (Renewed). Horticulture Research Institute.

Gu, M.. 2018. Effect of biochar and vermicompost on seed germination and seedling growth. TNLA GREEN Nov/Dec:22-23.

Gu, M.. 2018. Plants with Potentials: Yangmei. TNLA GREEN Sep/Oct:33-35.

Gu, M.. 2018. My 2 cents on crapemurder. TNLA GREEN July/Aug:25-26.

Gu, M.. 2018. Update on crapemyrtle bark scale. TNLA GREEN Mar/April:23-24.

Gu, M. 2018 Alternative hosts of crapemyrtle bark scale. 5/18. Texas A&M AgriLife Extension Service EHT-103.

Guo, Y., G. Niu, T. Starman, and M. Gu. 2018. Growth and development of Easter lily in response to container substrate with biochar. The Journal of Horticultural Science and Biotechnology. https://doi.org/10.1080/14620316.2018.1444514.

Guo, Y., G. Niu, T. Starman, A. Volder and M. Gu. 2018. Poinsettia growth and development response to container root substrate with biochar. Horticulturae 4, 1; doi:10.3390/horticulturae4010001.

Klett, James E. 2018 CSU Research Update. Superior Herbaceous Perennials from Colorado State University. CNGA Looseleaf 36(1) 20-21.

Klett, James E. 2018 CSU Research Update. Superior Woody Plants to Consider for 2018. CNGA Looseleaf 36(2) 18-19.

Klett, James E. and Ronda Koski. 2018 CSU Research Update. Pre-Emergent Herbicides for Container-Grown Ornamentals CNGA Looseleaf 36(3) 20-21.

Klett, James E. 2018. Plant Select® Introductions and Top Performers from the past. CNGA Looseleaf 36(4) 20-21.

Klett, James E. 2018. Top Performers from Professional and Consumer Day at CSU Annual Flower Trials CNGA Looseleaf 36(5) 20-21.

Klett, James E. 2018. CSU Research on trending plants. Colorado Green 34(1) 44-45.

Klett, James E. 2018. Top Performers for Colorado from CSU Perennial Trials. Colorado Green 34(2) 42-43.

Klett, James E. 2018. Top Performers from CSU offer more plant diversity. Colorado Green. 34(4) 42-43.

Klett, James E. 2018. Top 10 picks for offseason color. Colorado Green 34(4) 41-43.

Klett, James E. 2018. Best Viburnums for Colorado. Colorado Green 34(5) 42-43.

Klett, James E. 2018. Industry pros and gardeners vote top picks at CSU Annual Flower Trials. Colorado Green 34(6) 41-43.

Lawson, K.C. and L.A. Rupp. 2018. A preliminary study on the selection and establishment of pinyon pine clones for improved nut production. Annual report to the Utah Department of Agriculture and Food Specialty Crop Block Grant program.

Lawson, K.C., L.A. Rupp. and R. Newhall. 2018. Topworking mature two-needle pinyon (*Pinus edulis*) with singleleaf pinyon (*Pinus monophylla*). Poster presentation at the International Plant Propagator Society Western Region annual conference. Kona, Hawaii.

Lawson, K.C., L.A. Rupp. and R. Newhall. 2018. Selecting and grafting wild *Pinus monophylla* on containerized *Pinus edulis* rootstocks. Poster presentation at the International Plant Propagator Society Western Region annual conference. Kona, Hawaii.

Love SL. 2018. Penstemon degeneri. Bulletin of the American Penstemon Society 77:2-7.

Niu, G. and Y. Sun. Salt tolerance of roses. 2018. Acta Horticulturae (Accepted).

Alison Stoven O’Connor, James E. Klett and Anthony V. Koski. 2018. Container Type Affects Root Development of Chanticleer® Pear (Pyrus calleryana ‘Glen Form’) During Landscape Establishment. Arboriculture and Urban Forestry 44(4) 164-173.

Rupp, LA, Anderson MA, Klett J, Love SL, Goodspeed J, Gunnell J. 2018. Native and adapted plant introduction for low-water landscaping. HortTechnology 28(4):431-435.

Schuch, U.K. 2018. Tree irrigation requirements in the semiarid Southwestern United States. HortTechnology 28(4):427-430.

Sun, Y., G. Niu, C. Perez, H.B. Pemberton, and J. Altland. 2018. Responses of marigold cultivars to saline water irrigation. HortTechology 28(2): 166-171. <https://doi.org/10.21273/HORTTECH03981-1>