



**Oklahoma Department of Agriculture, Food, and Forestry  
(ODAFF)**

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**Final Report**

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# **DEVELOPING AN ORNAMENTAL DROUGHT TOLERANT EVALUATION PROGRAM FOR OKLAHOMA NURSERYMAN**

## **Project Summary:**

The ornamental industry in Oklahoma is continually searching for unique species for introduction as a way to sustain and expand the specialty market. An emerging niche is introduction of drought tolerant herbaceous taxa. The objective of this research is to provide the Oklahoma ornamental industry with needed information on drought tolerant species selections and management by establishing a center for evaluation and production in Oklahoma. Both native and non-native taxa will be collected from low precipitation areas within Oklahoma and throughout the United States. Research will include selection, evaluation, and mutagenesis of selected species. Information gathered from this project will support and strengthen the ornamental industry by providing needed information on new drought tolerant plant introductions along with creating novel regional adapted plant material.

Herbaceous ornamental plants continue to increase in popularity for use in private gardens and commercial landscapes in Oklahoma and across the United States (Ault, 2003). These plants are part of the 5 billion dollar floriculture market (Jerardo, 2003). Within the perennial market, consumer demand for drought tolerant plants has increased due to invasive plant and water conservation issues (Ault, 2003), and is considered an emerging niche market in the green industry (Brzuszek et al., 2007). Benefits of using drought tolerant taxa include the potential for reduced water, fertilizer, and maintenance.

Consumer demands for new drought-tolerant species to fit their landscape needs is driven by those specialty nurseries that sell or focus on introducing new drought tolerant plant sections every year. Sunshine Nursery (Clinton), Bustani Plant Farm (Stillwater), and Greenleaf Nursery (Tahlequah) are some examples of such nurseries in Oklahoma. Unfortunately, information is limited on drought tolerant species adaptability as well as the production and propagation practices needed before new plant can be introduced to the general public. There are a number of genera and species that have potential for commercialization but are only cultivated on a limited level as they have not been evaluated for growth habit, flowering characteristics, pest or disease problems (Fehr, 1991; Thomas and Schrock, 2004).

This project was not built on a previously funded project with SCBGP or SCBGP-FB.

## **Project Approach:**

### **Experiment 1**

Seeds from 53 different genera and over 150 different species were obtained from Plant World Seeds (Devon, U.K.) and Alplains (Kiowa, CO) in March, 2011 (see attachment at the end of the report for a list of plant species). Number of seeds per pot varied depending on seed source and each species had three replications. Seeds were either scarified, stratified, scarified and stratified, or just planted depending on germination instructions. Scarification treatments consisted of rubbing seeds once down a 15-cm (6-in) #320-grit aluminum oxide Emory cloth

(3M Company, St. Paul, Minnesota). Seeds to be stratified were planted near the surface in moist Redi-earth Plug and Seedling Mix (SunGro Horticulture, Bellevue, WA) located in standard 6 inch (15.24 cm) pots each with 0.35 kg of medium and then placed in a cooler for 6 or 8 weeks at 4 °C (39 °F). All seeds were lightly covered with media to a depth of 1.3-cm (0.5-in). After stratification and scarification treatments, all seeds were placed in the greenhouse at 20 °C (68 °F) on 25 March, 2011. Seedlings were transplanted into research plots at the Oklahoma State University Research Station in Perkins, OK (USDA hardiness zone 7a) May, 2011. *Zephyranthes rosea*, *Zephyranthes* 'Prairie Sunset', *Zephyranthes candida*, *Zephyranthes* 'Citrina', *Zephyranthes grandiflora*, and *Zephyranthes* 'Pink Beauty' bulbs were bought from Edens Blooms (Thatcher, AZ) and also planted out in the field. Drip irrigation was used as needed to help establish the plants the first year. Plants were planted on one foot spacings. Data collected included summer survival, flowering, plant height and width data in September, and winter hardiness data in May, 2012.

## Experiment 2

Seeds of *Asclepias incarnate*, *Asclepias pumila*, *Asclepias syriaca*, *Asclepias tuberosa*, *Astragalus racemosus*, *Astragalus crassicaarpus*, *Astragalus Canadensis*, *Baptisia alba*, *Baptisia australis*, *Baptisia bracteata*, *Baptisia minor*, *Baptisia sphaerocarpa*, *Baptisia tinctoria*, *Vernonia fasciculata*, *Vernonia missurica*, *Callirhoe digitata*, *Callirhoe bushii*, *Callirhoe involucrate*, and *Callirhoe triangulate* obtained from Prairie Moon Nursery (Winona, MN) in March, 2011. Fifty seeds per pot per treatment with three replications. Treatments included either 0.3%, 0.6%, or 0.9% ethyl manesulfanate (EMS) and letting the seeds soak for 48 hours. After soaking, seeds were lightly covered with moist Redi-earth Plug and Seedling Mix (SunGro Horticulture, Bellevue, WA) media to a depth of 1.3-cm (0.5-in) then placed in the greenhouse at 20 °C (68 °F) on 5 March, 2011.

## Significant Results

- No seed germination occurred for 56 of the species in Expt. 1, which was the result of nonviable seeds like *Zephyranthes*, lack of efficient seed treatments including alternating warm/cold cycles like *Cymopterus*, *Phlox*, and *Penstemon*, or seeds that may not germinate for several months including *Astrantia*, *Fascicularia*, *Eucomis*, *Fendlera*, *Shepherdia*, *Zauschneria*, and *Salvia*.
- 54% of plants planted in the field survived the first summer, which was the hottest summer on record in Oklahoma.
- Only 1 plant, *Dalea bicolor* v. *argyraea*, flowered the first year.
- 77% of the plants that survived the summer also survived the mild winter of 2011-2012.
- Genera and species that survived the summer and winter include *Dierama* species mixed, *Echium italicum* 'White', *Erysimum* 'Plant World Rainbows', *Euphorbia baselicis*, *Lavendula angustifolia*, *Lavendula* 'Van Gogh's Babies', *Verbascum* 'Cottage Garden', *Amsonia eastwoodiana*, *Amsonia elliptica*, *Amsonia hubrichtii*, *Amsonia tomentosa*,

*Asclepias eriocarpa*, *Asclepias hallii*, *Asclepias latifolia*, *Asclepias tuberosa*, *Baptisia australis*, *Baptisia bracteata*, *Dalea bicolor* v. *argyraea*, *Dalea formosa*, *Dalea ornate*, *Dalea pulchra*, *Dalea purpurea*, *Dalea villosa*, *Enceliopsis argophylla*, *Leucophyllum minus*, *Sphaeralcea ambigua*, *Sphaeralcea gierischii*, *Sphaeralcea munroana*, *Sphaeralcea parvifolia*, *Salvia dorrii* v. *carcosa*, *Salvia dorrii* v. *dorrii*, *Salvia pachyphylla*, and *Penstemon cyananthus*.

- All of the *Zephyranthes* species and cultivars survived in Oklahoma's hardiness zone 6b/7a, which is on the border for the hardiness zones (7-10) listed for the species.
- Blister beetles were found to be significant pests of *Zephyranthes* as they would eat and damage the leaves, flowers, and seed pods. The Genista broom moth caterpillar is a significant pest on *Baptisia*. The yellow Oleander aphid is a significant pest on the *Asclepias* species as 1,000's of aphids can cover a single plant restricting growth.
- Plant evaluation recommendations are generally made after multiple years to take into account yearly environmental fluctuations, but because last summer was one of the hottest summers on record for Oklahoma, the plants that survived the summer of 2011 have potential in Oklahoma landscapes. Because last winter was mild, it was not a good indicator of which plants are also adapted to survive typical winters in Oklahoma.
- In the literature, ethyl methanesulfanate (EMS) has been reported to be effective at inducing mutations at concentrations ranging from 0.01% to 2% with seed soak times ranging from a few hours to multiple days depending on the plant species. In this study only a few plants of *Baptisia* were obtained by soaking seeds in 0.3%, 0.6%, and 0.9% for 2 days. No mutations based on plant growth or leave distortion have been seen. Recommendations for soaking ornamental seed in EMS would be to reduce the soak time to 12 to 24 hours and use low EMS concentrations ranging from 0.1% to 0.5%.

Dr. Dunn oversaw the purchase of supplies, seed and field planting, EMS treatments, data collection, and information dissemination. Student labor was used to count seeds, fill pots with media, watering plants, field preparation, field planting, field maintenance, and data collection.

### **Goals And Outcomes Achieved:**

The two goals for the project are listed below with the measurable outcomes. Attached to this report is some baseline data that has been gathered.

1. Evaluate drought-tolerant native and non-native ornamentals and bulbs for nursery potential in Oklahoma.

Research plots were established at the Cimarron Valley Research Station in Perkins, OK. Overall, plants from 34 different genera and 85 different species were planted in the field and evaluated for winter and summer survival.

2. Facilitate new plant introductions by using a chemical mutagen (EMS) to induce mutations to facilitate introducing plants with ornamental merit.

EMS, at concentrations of 0.3%, 0.6%, and 0.9% for 48 hours, was not found to facilitate plant mutations, and instead was lethal to most germinating seeds.

### **Beneficiaries:**

The public and horticulture industries in Oklahoma including Bustani Plant Farm, Sunshine Nursery, and Sooner Plant Farm that focus on native or well adapted plants to Oklahoma have and will continue to benefit from the established drought tolerant research program in Perkins, OK, through talks, field days, site visits, and publications. A segment of Oklahoma Gardening, which has over 175,000 weekly viewers, was filmed at the research plots on August 22 to discuss the research and which plants have performed well so far. Plants that perform well will be recommended to the Oklahoma Proven program that provides homeowners in Oklahoma with plants that perform well in Oklahoma.

The data collected on summer and winter survival listed in the table attached provides quantitative information about which plants have the potential to perform well in Oklahoma if planted from seed and planted in May in Oklahoma. The potential economic impact comes from making recommendation to the public and growers about which plants will perform well in Oklahoma. The first year results that were presented at a research conference are available online on my departmental webpage <http://www.hortla.okstate.edu/faculty/dunn/index.htm>.

### **Lessons Learned:**

Had I known that so many seeds would not germinate, then I would have bought more seeds from several other sources to supplement the two seed sources that I did use.

Not all species within a genus grow well under Oklahoma conditions.

Several species selected for this study have shown drought/heat tolerance and winter hardiness.

No major pests have been reported previously for *Zephyranthes*, so it was interesting to find that the Blister Beetle (*Epicauta conferta*) found in Texas, Oklahoma, and Kansas will feed heavily on the rainlilies.

I was a little surprised that over half of the plants still survived the first summer despite the record setting temperatures. Because it got heat early, I was not sure if the plants would have time to establish.

The fact that the EMS concentrations used were lethal to the seeds was unexpected, since higher rates are reported to be successful for other plants.

For future studies with EMS, I would recommend preliminary trials to establish a lethal dose at 50%. The EMS concentrations would be between 0.1% and 0.5% EMS and soak the seeds for 8-24 hours.

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**Additional Information:**

**Appendix A** Attached is a smaller version of a poster from the research that was presented at the American Society for Horticultural Sciences annual conference in Miami, FL, which had over 500 students, research scientists, and industry members attending. The abstract from the poster was published in the HortScience journal (<http://www.ashs.org/downloads/supplement/2012ASHS-AnnualConference.pdf>), and the poster itself is available online by linking on a link on my departmental web page <http://www.hortla.okstate.edu/faculty/dunn/index.htm>.

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## **DOMESTICATION AND UTILIZATION OF NATIVE PLUM (PRUNUS GRACILAS) IN OKLAHOMA**

**Project Summary:**

Oklahoma has a wealth of diversity in native plums often referred to as the sand plum (*Prunus angustifolia* Marsh.). Management strategies to improve fruit size, yield, and quality have not been well studied. Sand plum produces viable fruit, but the plants are thorny and have the tendency to sucker. If sand plums were trained for an orchard system, excessive sucker removal would be required which would increase labor and propensity towards disease. Grafting of sand plum onto non-suckering rootstocks would reduce this problem, but information on graft suitability of sand plum is unknown. The lack of information regarding graft compatibility could lead to discovery of incompatibility years later, which would be costly for the grower. Also, only two commercial cultivars exist for sand plum and none of these have been bred specifically for fruit. The purpose of this project was to determine suitable graft compatibility with common rootstocks and to select superior genotypes for further study.

Commercial interests in the use of sand plum fruit has risen as of the past few years. Markets dedicated to Made in Oklahoma foods and the local food movement have contributed to this increase. Sale of a fruit native to Oklahoma could be especially attractive to local homecraft makers and wineries. Cultivar development is not extensive for sand plum and further development of more desirable and uniform varieties would be useful for Oklahoma nurseries and growers for sand plum production.

## **Project Approach:**

### 2012

Three sites were planted with three different rootstock types ('Lovell' (*Prunus persica* L.), myrobalan (*Prunus cerasifera* Ehrh.) and 'St. Julien A' (*Prunus insititia* L.)) on February 27-March 3, 2012. At Perkins and the 1<sup>st</sup> Crescent site 150 trees of 50 trees per rootstock type were planted. Forty-three trees at a 2<sup>nd</sup> Crescent site were planted. Plantings were randomized.

Sand plum populations in Payne, Kingfisher, and Logan counties were surveyed for bloom time, flower production and mottle health. Forty-six mottles were found, but mottles were struck from this list if they were incorrectly identified, too small for harvesting of budwood, on private land, possessed excessive insect damage or low fruiting and flowering.

All rootstock was t-budded May 8-May 11, 2012. Initially 16 buds out of 150 at the Perkins site and the 1<sup>st</sup> Crescent site were considered successes. None were initially considered successful at the 2<sup>nd</sup> Crescent site. Successful buds were eventually determined to be failures due to lack of emergence and 'successful' buds falling off trees.

All sites were chip budded June 18-22, 2012. Four sand plum types and one peach variety were grafted. Peach varieties were added in as a control. Survival after three weeks was three at Perkins and five at Crescent. These buds were eventually considered failures due to lack of emergence.

Perkins field site was re-chip budded October 22-26, 2012. A peach control was used and humidity was above 40% when budding took place. The hope was that milder conditions along with extra encasement of buds may increase bud survival. Thirty-four of the 150 grafted buds were considered viable, but never emerged. Large numbers of the buds were still attached to the tree, but the buds themselves were dead.

### 2013

Two sand plum varieties and 'Redhaven' peach were cleft grafted onto 60 trees at the 1<sup>st</sup> Crescent site on March 6-8, 2013. On March 8, 2013, surviving trees at the 2<sup>nd</sup> Crescent site were cleft-grafted with mix of sand plum and 'Redhaven' peach. Four sand plum varieties and 'Harvester' peach were cleft grafted onto 140 rootstock at the Perkins site. Both scion and rootstock were dormant. Grafts were wrapped with vinyl tape to add pressure to graft. Cut surfaces were painted with white exterior paint to retain moisture and to protect trees from disease. One sand plum graft emerged on a peach rootstock at the 2<sup>nd</sup> Crescent site, but died within a week. None emerged at the 1<sup>st</sup> Crescent site. Ten out of 140 grafts emerged at Perkins. Four of these emerged, but the grafts turned black and died a week after. Two grafts were knocked out by animals or broke when birds landed on them. Three grafts died from unknown causes. As of July 2013, one cleft graft (sand plum grafted onto myrobalan rootstock) remained alive. It is expected to survive. No peach grafts emerged at any site.

On March 27, 2013, selected sand plum mottles were resurveyed. Bloom time, insect damage and flowering amount was noted. Trees were found to have great variance in flowering, and

trees that had flowered later the prior year were found to flower later this year as well, though all mottes flowered at least 10 days later than the prior year.

On February 25, 2013, 160 trees, 40 trees per rootstock type, were planted in 2.45 liter pots at the Oklahoma Department of Horticulture and Landscape Architecture Research Greenhouses in Stillwater, OK. Rootstock consisted of 'Lovell', 'Nemaguard' (*P. persica* × *P. davidiana*), 'Myrobalan 29 C' and St. Julien. Height of all rootstock was reduced to 1-1 ½ ft. Spacing was staggered 4x4 ft with 10 blocks. Budwood from three sand plum mottes was used and 'Intrepid' peach was used as a control. Buds were at least one year old or older. Trees were budded February 26-March 1, 2013 in the greenhouse. Grafting method was chip budding. Buds were wrapped with parafilm buddy tape and tied with a rubber band. Grafting knives were sterilized between each graft with a dip in 50% diluted bleach solution, then two separate rinses in tap water. Trees were placed on drip irrigation but were hand watered when dry. Bud emergence began March 5, 2013. Tops of trees were cut to just above buds in order to better force emergence. Bud emergence continued until April 19, 2013. Overall bud take was 65%. Fertilizer was administered March 20, 2013 at 12 g per tree of Scott's Osmocote 3-4 month mix. Fertilizer was applied again at 8 g per tree of Scott's Osmocote 3-4 month mix on May 17, 2013. Trees were staked to prevent horizontal growth. Height measurements were taken from April 5 until May 31, 2013.

Ninety-one trees were outplanted May 31, 2013 at the Perkins field. Rootstock from prior field experiments was removed the week before planting. Trees were spaced at 4.3 m between trees and 6.1 m between rows. There were approximately 13 trees in each row, except for the first row which had 12. Trees were irrigated using the drip system from former planting. Ten trees were considered either to have grafts that would be too weak to withstand heavy wind or to have notable nutrient deficiencies and were not outplanted.

Water was accidentally left on overnight June 7 and over the weekend on June 28-July 1, 2013. Fertilizer had just been applied June 27 at the rate of ½ lb of 19-19-19, which increased tree stress. As of late July 2013, 44 trees appear healthy while 40 were in shock and seven were dead. Tree circumference measurements were taken July 17, 2013 for use in further incompatibility studies. Data on plant survival, graft compatibility, flowering, fruiting, and plant growth parameters will continue to be collected in subsequent years for a future publication.

Recommendations are to use dormant rootstock and budwood, as well as use appropriately sized rootstock. Chip budding early in the year was the most successful method

### **Goals and Outcomes Achieved:**

1. Superior wild genotypes were identified for use as varieties, and were outplanted on rootstocks for future evaluation.
2. Rootstocks selected demonstrated preliminary benefits and disadvantages for suitability.
3. Graduate student was educated and basic propagation information about sand plum was determined.

### **Beneficiaries:**

Results of and general information about sand plum was typed into an extension document for wide dispersal for use by nurseryman, growers, specialty crop producers, and the public. The documents have been downloaded by 420 individuals in 2013 and can be viewed at <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-8676/HLA-6258web.pdf>. Results were presented at the graduate student's final seminar to 15 faculty members at Oklahoma State University and to 85 fellow researchers at ASHS. The abstract from the talk was available online and has been viewed by around 10 individuals. Grafting information was shared with owners of Crescent field sites.

### **Lessons Learned:**

Grafting was successful when dormant scions and rootstocks and material of appropriate caliper size was used. Use of controlled climate conditions increased graft success as well. Grafts of peach and sand plum to 'Myrobalan 29 C' rootstocks were shorter than the same grafts on different rootstocks, which may indicate future incompatibility. St. Julien rootstock had the lowest graft take in the greenhouse grafting experiment. Staking of grafted sand plums was found to be necessary in order to induce upright growth habit.

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### **Additional Information:**

Along with the fact sheet, two manuscripts have been written and are currently under review in peer reviewed journals.

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## **OKLAHOMA GROWN SPECIALTY CROP PROMOTION**

### **Project Summary:**

This project builds on previous work of specialty crop grants funded by the USDA. Competitive grants up to \$2,000.00 were offered to 100% Oklahoma Grown Farmers' Markets to enhance the competitiveness of Ok Grown specialty crops. The farmers' markets grant funding is only used for one year, and therefore cannot be duplicating previous grants as they are not running concurrently. This grant was to be solely used for the purpose of promoting the consumption, purchase, and/or production of specialty crops. ODAFF staff and a review committee scored and awarded the markets with the best proposals. The Markets then used the funds for advertisements, newsletter publishing, and other promotional items. The funds continue to be

very beneficial to the expansion of 100% Oklahoma Grown Farmers' Market in our state with the Ok-Grown program growing to 68 markets this year.

In 2010 the Oklahoma Department of Agriculture, Food, & Forestry awarded 28 selected 100% Oklahoma Grown Farmers' Markets. Out of the 28, all of the Farmers' Markets awarded consist of small producers who rely on direct marketing to sell their products. With no major wholesaler, Farmers' Markets continue to be the major outlet for the growers to sell their fruits and vegetables. ODDAF decided a diverse way to impact growers across the state is to administer grants to the Farmers' Markets. It was our feeling that by administering grants, it would increase consumer demand and increase the number of specialty crop growers in the state.

It is not economically viable for small producers who solely market their specialty crops at one or more of our statewide farmers markets to purchase print advertising to promote themselves to the general public. With this in mind and the fact that only 28 out of the 68 100% Oklahoma Grown Farmers' Markets received grants to help with marketing; ODAFF used a portion of grant funds to advertise in the Oklahoma Living magazine. Oklahoma Living is a monthly publication of the Oklahoma Association of Electric Cooperatives and has a readership of over 650,000 individuals making it the largest publication in Oklahoma. A half page ad ran in the magazine from June through September that listed the locations of all the 100% Oklahoma Grown Farmers' Markets and hours of operation. The advertising was not only beneficial to registered 100% Oklahoma Grown Farmers' Markets but it also encouraged other markets to become 100% Ok-Grown.

### **Project Approach:**

ODAFF was able to award 28 selected 100% Oklahoma Grown Farmers' Markets out of 59 Markets that applied. Grants were made available on a competitive basis to existing and start up markets that are, or plan to be, 100% Oklahoma Grown Farmers' Markets. These grants were to be solely used for promoting the consumption, purchase, and/or production of specialty crops. The markets applied for the grants through a competitive application process. ODAFF staff and a review committee scored the markets and awarded the markets with the best proposals. Markets that were awarded used the grant funds for advertisements, promotional ads, and newsletter publishing. To insure that the grant funds were used properly, progress reports and two onsite visits were made to each Farmers' Market that received specialty crop funds. Reports show that the markets receiving grants saw a slight increase in sales from the previous year, even with the record heat and drought.

ODAFF requested and was approved for a change of scope to use grant funds for advertising in the Oklahoma Living Magazine. A half page ad for four (4) months was in the magazine. We felt by advertising these markets, production and consumption would increase. Only registered 100% Oklahoma Grown Farmers' Markets were in the magazine which also urged other markets to join the Ok-Grown program and insured this project promoted specialty crops.

### **Goals And Outcomes Achieved:**

Our goal with this project was to build consumer confidence in OK Grown products by educating them about the benefits of eating fresh fruits and vegetables that are locally grown. Reports from the Farmers' Markets show that the total number of producers is greater than 750. Oklahoma Grown Farmers' Markets has also increased to 68. Markets that received grant funds of up to \$2,000.00 reported a sales increase of 6% from last year. ODAFF was able to track sales of low-income consumers by receiving data from the piloted EBT machines. From 4,070 transactions, over \$70,000.00 was reported from EBT machines this year.

The goal of the magazine advertising project was to give the public a greater awareness of places to purchase fresh fruits and vegetables. This project helped tremendously with the impact of sales later in the season when markets tend to see a drop in customer attendance. Only promoting OK Grown markets in the advertisement has helped served as a catalyst for membership of 100% Oklahoma Grown Farmers Markets as the program has increased to 68 markets this year.

### **Beneficiaries:**

The beneficiaries of this program were all 100% Oklahoma Grown Farmers' Markets and producers selling at these markets. End of the season production reports from Farmers' Markets that were awarded grants showed that over 400 producers participated in the markets and benefited from the specialty crop funds. Markets that received grants continue to show a large increase in consumer demand, producer participation, and sales. Offering grants of up to \$2000.00 and using funds for advertising in the Oklahoma Living magazine has been very beneficial to the expansion of the Ok-Grown program and the growing demand of customers in our state.

### **Lessons Learned:**

Advertising is critical to a market's success especially those newly established markets in rural and urban areas. Consumers are looking for places to purchase fresh locally grown produce and if they are not aware of the locations of these markets they will go elsewhere. Without some assistance many of our markets would not be able to conduct marketing campaigns.

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### **ADDITIONAL INFORMATION**

N/A

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## **OKLAHOMA PROVEN PLANT SELECTION PROGRAM**

### **Project Summary:**

*Oklahoma Proven (OKP)* is a promotional and plant evaluation program designed to help consumers choose plants appropriate for Oklahoma gardens. Consumers are sometimes frustrated with choices of plant material found in some garden centers and often lack the knowledge to select appropriate plants. In general, there is a significant demand for low input plant materials that are relatively pest free. There are also many plants common to the trade used with great success in Oklahoma, yet remain unknown to the gardening public. The hope is that aiding consumers with plant selection will lead to greater gardening success, enthusiasm, and increased sales for Oklahoma green industries. The program started in 1999 and has been very successful to date. Each year a tree, shrub, perennial, and annual is chosen and promoted. Promotion of *OKP* occurs throughout the year, but a concentrated media push in early March is the marketing goal. Posters and brochures are distributed to local nurseries and county extension offices promoting *OKP* plants making it easy for consumers to identify plants that will do well in their gardens. Photographs of *OKP* Plant Selections and the *OKP* logo are available online for use by the media or industry professionals.

### **Project Approach:**

This is an ongoing program, so activities for the promotional year (2011) begin the prior year with taking and selecting pictures for promotional material. In the fall the promotional material is created. This material includes updating the web site, developing a poster and brochure, creating flyers, creating a Power Point presentation, and writing articles for news releases. In 2011 we promoted Silver Linden (Collector's Choice), disease resistant American Elm cultivars (Tree), compact Abelia varieties (Shrub), Giant Coneflower (Perennial), and Pink Crystals Ruby Grass (Annual).

In late 2010/early 2011 brochures and posters are printed. We printed 10,000 brochures which provide names and pictures of each plant chosen since the beginning of the OKP program in 1999. We mailed two copies to retailers, educators, and others on our OKP mailing list and invited people to request more copies if they so desired.

In early 2011 we distributed approximately 600 posters to retailers, growers, and county extension offices. By the end of 2011 we distributed nearly all 10,000 copies of the brochure.

Promotion of Oklahoma Proven occurs throughout the year, but a concentrated media push in early March is the marketing goal. Local nurseries receive the posters and brochures and a majority of the brochures are distributed to county extension offices and through various workshops and events held throughout the year. The photographs on the OKP Plant Selections webpage and the Oklahoma Proven logo are available for use by the media or industry professionals.

In September, Mike Schnelle attended the ONLA Trade Show and distributed fliers of the OKP list and sought feedback and comments from ONLA members. Mike Schnelle also serves on the ONLA Board.

Oklahoma Proven Project partners include an advisory committee made up of university (educators), industry (growers – retail and commercial, landscape, and other horticulturists), and staff in the Agricultural Communications Services Unit. The Advisory Committee acts as a resource for the marketing and plant evaluation coordinators and meets at least once a year. Agricultural Communications staff assists in the layout, design and printing of the poster and brochure.

### **Goals and Outcomes Achieved:**

The *Oklahoma Proven* Selection Program will help consumers choose plants appropriate for Oklahoma by marketing “Proven” plants selected from the evaluation program and from surveys targeted at identifying under-utilized plants. The marketing effort will be statewide and will include television promotion, point-of-purchase materials, and other marketing efforts.

Examples include:

- Approximately 175,000 weekly viewers through the *Oklahoma Gardening* television program were exposed to OKP plants through two episodes which aired June 11 and 12, and September 24 and 25, 2011. Also many OKP plants were planted and labeled in the studio garden which is visited by hundreds of visitors each year.
- Exposure to OKP plant material through workshops, training, and presentations (4 workshops and over 16 presentations through our department alone) were given to the general public, Master Gardener (MG) volunteer program, extension personnel, and industry. OKP plants were introduced to 268 new Master Gardener volunteers in 13 counties through training. We were unable to poll the Master Gardener Volunteers directly this year so the following survey was sent to all the County Extension Offices with Master Gardener Volunteer Programs at the end of the year. (responses to the questionnaire were provided in the initial report).
  - Approximately how many public presentations (PowerPoint or other) were given by you or your MGs promoting the Oklahoma Proven plants? 67
  - How many news, newsletter or magazine articles were written highlighting OK Proven plants? 46 (literally 100,000’s of people have been exposed to the program through mass media outlets).
  - How many public programs such as county fairs, plant clinics, spring or fall garden shows were conducted where OK Proven material was handed out? 37
  - Comments from MGs or clients about the program, positive or negative? One county reported a few negative or concerned comments during one presentation: Kentucky Coffee Tree seed pods could be a nuisance (however, they were reassured there is a male clone available that does not produce seed pods); Bosnian Pine-can’t find in nurseries; Several wanted to know where to purchase Bur Oak; several thought Winter Jasmine was not a good choice for OK proven shrub.
- Media coverage included a press release and article; article in the February 2011 issue of *Horticulture Tips* (<http://www.hortla.okstate.edu/resources/horttips/pdf/archive/2011/february.pdf>). The county educators use *Horticulture Tips* for articles in their local newspapers and newsletters.

- Plantings of the OKP plants are found at many of the display gardens managed by Master Gardeners. Garfield County is establishing an arboretum next to their office highlighting woody plants and has planted many of the herbaceous plants around the building. Kingfisher County Extension has established demonstration plantings with Oklahoma Proven plants at their office.

The Oklahoma Proven website was updated and redesigned this year, <http://oklahomaproven.okstate.edu/>, providing easy access to information as well as high resolution images free for use.

### **Beneficiaries:**

County Extension offices benefit by the materials provided by using them for programming to their clients (residents). The Master Gardener Volunteers work through the county offices and often conduct the educational programming for the county. The brochure is used extensively by extension educators and Master Gardener Volunteers for workshops and lectures. In addition, others groups reported the following:

- Many agencies use and promote the material and plants such as a tree planting project at area elementary schools sponsored by Oklahoma Natural Gas, and the Oklahoma Nursery and Landscape Association supports the program through newsletter reminders and a link to the OK Proven website on their web site.
- In addition, the Tulsa and Washington Counties' Master Gardener Tulsa State Fair Booth highlighted Oklahoma Proven plants, mostly trees and shrubs, and was well received; Several clients (10-20) and homeowners contacted one county office about tree problems and commented that they have planted various OK proven plants (mainly trees) that have done very well for them; and Mary Gilmore Caffrey, Executive Director of The Tree Bank Foundation, indicated they treasure the Oklahoma Proven materials and share them with their volunteers, project partners, and donors (website: [www.thetreebank.org](http://www.thetreebank.org)).

### **Lessons Learned:**

We have learned through the annual plant selection process (OKP Executive Committee meeting) that feedback from consumers and Master Gardener's is they appreciate that the program supplies a conduit for communicating to commercial growers the plant materials deemed suitable (often underutilized) for Oklahoma. These underutilized plants have great potential if their numbers could be propagated to meet the demands of the consumer. The green industry can now go ahead and further propagate such underutilized species having the confidence that via the Oklahoma Proven material distributed statewide and through conferences and workshops, the demand will be there and the grower has several years to get the numbers built up to meet the demand.

Unexpected outcomes have been, on occasion, a lack of supply from the industry for some of the plants selected for the program. We give the industry every opportunity to participate in the selection of plants and enough notice of upcoming selections so that there will be enough available that year, but still run into availability issues for some plants. The program has become

more of an educational program than an introduction program as previously designed and focuses on educating the public on underutilized species/cultivars that are generally available in the trade.

Identifying effective ways to survey the Master Gardeners and the green industry will be pursued. Possible venues for surveying these groups are the statewide Master Gardeners Conference, a state Master Gardeners online reporting system, and the ONLA newsletters and yearly conferences/workshops.

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**Appendix B** is a copy of the 2011 Oklahoma Proven poster with pictures of the Collector's Choice, tree, shrub, annual and perennial. **Appendix C** showcases each selection and gives a brief description of each plant and the growing conditions they prefer.

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## PLASTICULTURE GARDEN GRANTS

**Project Summary:**

The plasticulture garden program is Oklahoma Department of Agriculture's initiative to partner and assist limited resource farmers in raising specialty crops. This grant builds on other previously funded Specialty Crop Block grants. The Oklahoma Department of Agriculture Food & Forestry's plasticulture garden grant program allows selected individuals to participate in the program for a maximum of three years. As producers complete their three years in the program and roll off; we are able to add new producers. We are able to bring in on average 20 new growers each year.

**Project Approach:**

Grants to participants are awarded by a competitive process. Press releases were sent to statewide news publications to promote the grant and encourage participation. Individuals must qualify based on Langston University's definition of a limited resource farmer being defined as a person with a direct or indirect gross farm income of not more than \$100,000 in each of the two previous years and has received little or no assistance from the government. The program is also limited to participants with forty (40) acres or less. The plasticulture grant recipients were selected by a review committee of three people who were associated with Cooperative Extension in the state. After the participants were selected, the Oklahoma Department of Agriculture assisted in the installation of up to one acre of plasticulture.

With the assistance of our contractors, 67 gardens were installed with plastic mulch and drip tape for producers and 3 demonstration gardens were installed to show the benefits of growing on plastic. Due to a higher turnover rate than normal we were able to accept 27 new individuals into the program.

Participants may install a minimum of ¼ of an acre; up to 1 acre of ground with plastic. The farmer must have taken and submit water samples to demonstrate they have an adequate water supply in which to irrigate. Participants are also required to have all ground work completed and the soil ready for the raised bed process. Contractors will schedule a time with the participants to visit their locations. The contractors will use their machinery to form raised beds while laying a line of drip irrigation while covering the bed with the sheets of plastic. The contractors will also hook up the irrigation system. Participants also received technical support during the growing season about what and when to plant.

By requiring the participants to sell a minimum of 50% of the produce they grow the plasticulture program is helping to generate revenue for the farmers along with providing access to healthy nutritious fruits and vegetables to both their families and people in the community who are purchasing these items at local outlets. Participants are required to submit annual production reports to illustrate how much produce they grew along with sales of their products. ODAFF staff works with the participants by providing them with the appropriate forms for their production reports along with making sure that each participant submits a report. To insure that reports are completed, a portion of their contracts state that if they do not provide ODAFF with the appropriate production reports they will not be eligible to participate in the plasticulture program in future years.

Each March a conference is held for producers interested or currently participating in the plasticulture program. The annual conference is attended by over 150 growers as they learn the benefits of growing on plastic mulch, how to utilize drip tape for irrigation to increase their production while decreasing water use. This is a good time for producers to network with one another and discuss techniques and crops that worked and didn't work for them in the plastic.

### **Goals and Outcomes Achieved:**

The Plasticulture Program was designed to help limited resource farmers with their production of specialty crops by using more efficient production methods thus providing them with more produce to market at Oklahoma venues. We have seen that the majority of farmers who stay in the program the entire 3 years gain confidence in their ability to grow and market specialty crops. As with most farmers now the majority of the participants have a full time job and farm on the side. The production of specialty crops can be labor intensive, but due to the advantage of weed suppression, better water retention in the soil and increased utilization of water through drip irrigation; plasticulture makes it possible to be successful growing specialty crops even for those who are doing it as a side job. Participants also increase their business skills by completing the production reports and tracking the sales of items along with their expenses for growing, learning the importance of better record keeping.

### **Beneficiaries:**

The 67 individuals who were selected to participate in the program directly benefited by increased revenue from the production of specialty crops. Each recipient is required to keep production records throughout the year. This year participants showed sales of over \$105,000.00 worth of specialty crops. The health and nutrition of the families who participated also benefited by being able to consume a portion of the produce that was grown. Producers also estimated that \$10,800 worth of produce was not sold and consumed by their families. The consumers who live around the participants also benefit from the plasticulture program. Most of the participants live in rural areas of the state that could be classified as “food deserts” where there is not an ample access to fresh fruits and vegetables. By selling either directly from the farm or through one of our many OK Grown Farmers Markets provides those consumers with produce that is fresh and healthy for them rather than having to drive several miles to the nearest grocery store and buying produce that has been shipped in from outside the country.

### **Lessons Learned:**

Weather is always a fact when growing specialty crops. In 2011 and 2012 Oklahoma producers faces back to back years of exceptional drought although some moisture was received during the winter months during 2012 which benefited growers with some subsoil moisture at the beginning of the growing season. One thing we are beginning to realize is how well root crops do under the plastic mulch. The mulch has the ability to hold moisture and provide deep saturation from the drip tape which provides a good growing environment for crops such as sweet potatoes.

Another lesson learned is the importance of keeping up with your watering schedule during dry times. If the soil becomes dried out it is hard to catch back up and does not provide the usual benefits of the plastic mulch. Once the temperature exceeds 95 degrees (which was sometime the temperature at 11 pm during this drought), it will take an extremely long time to get the beds saturated again.

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### **Additional Information:**

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## **HARVEST OF THE MONTH II**

### **Project Summary:**

This project builds on the success of a previously funded specialty crop grant that made connections to Oklahoma’s specialty crops through visual, auditory, and kinesthetic educational applications. Obesity rates in Oklahoma’s youth are high while their consumption of fruits and vegetables are low. The project was developed to address unhealthy eating habits of Oklahoma

youth through education of Oklahoma's specialty crops. A set of 12 educational posters were developed featuring 15 of Oklahoma's specialty crops. The posters were developed to be used in grades Pre-K through 8<sup>th</sup> and provided educators with colorful photos to aid in recognition of fruits and vegetables along with links to lessons and resources that corresponded to the specialty crop.

### **Project Approach:**

A planning committee made up of AITC staff, Oklahoma State University (OSU) staff and members of the Oklahoma Fruit and Vegetable Association met and discussed which specialty crops would be selected for the set of 12 posters. After eliminating the crops utilized in the initial Harvest of the Month project it was decided to select 15 specialty crops to be highlighted within the set of 12 posters. The crops selected were: apples, beets, blackberries, blueberries, black-eyed peas, broccoli, cauliflower, cantaloupe, carrots, green beans, pears, peppers - sweet and hot, radish and greens. Each poster provided students colorful photos for easy identification of the crops along with factual and nutritional information to be used by the educators. The 15 crops selected were done so because they could be correlated to at least one or more lessons provided by Ag in the Classroom. Math, science and language art skills are incorporated into the lessons as the students learn about the various specialty crops.

This project had very little if any unusual developments. Time researching the radish poster lesson connection through the 300 lessons and activities on the OAITC website was the only snag. 10,000 sets of posters were printed in July 2013 and have been very well received by educators at several state conferences including a 2,000+ professional development workshop, an American Indian Institute conference, regional workshops, and the Ag in the Classroom summer conference.

### **Goals And Outcomes Achieved:**

The activities completed to achieve the performance goals and measurable outcomes included development, production, and distribution of the Harvest of the Month II posters, professional development for educators, website promotion through all resources and lesson, and education conference attendance.

The major success of the project comes in terms of website hits on the lessons and resources connected to the Special Crop posters. The number of hits for the lessons during the Fall Semester of 2013 was 312 and 87 of those were on the poster page specifically.

#### **Lessons featured in HOM2**

#### **# of Web hits Fall 2013**

Oklahoma's Roots and Leafy Greens	31
Oklahoma's Berry Best	11
A Bean Is a Seed	38
Plant Parts We Eat	33
Melon Madness	21
Melon Meiosis	18

Field of Beans	16
The Nightshades	44
Garden Grid	13
Posters Page	87
Total	312

In Oklahoma, the Ag in the Classroom program is a partnership between ODAFF and Oklahoma State University Cooperative Extension. As a portion of the agreement OSU staff administers and host the AITC website. The staff member who oversees the website had their computer crash and lost several files. Unfortunately the goal of increasing the number of web hits by 50 percent is not able to be tracked due to lost files as a result of the computer crashing. The posters have only been on the website for one semester and from the numbers above show high interest from educators.

**Beneficiaries:**

Formal and informal educators around the state benefited by receiving resources for classroom use that were aligned to state standards that connected specialty crop lessons and activities. The resources were developed and provided at no cost to the educators or school systems. Students within these classrooms will also benefit by being introduced to the 15 different specialty crops utilized within the posters. Ag in the Classroom received the posters from the printer at the end of July, 2013 and from that date have trained 244 Pre-Service Educators, 684 educators (each teacher sharing with 20 students), and 13,680 students. The students learned about the nutritional values and health benefits of each crop. Parents were encouraged to utilize the various fruits and vegetables in meals so that the students would become more accustomed to eating them. Oklahoma specialty crop producers were able to indirectly benefit by the increased demand for the products.

**Lessons Learned:**

One of the lessons learned through this project was to draw on the success of previous projects, such as the original set of Harvest of the Month posters developed. They were received very well by educators, nutrition directors, and more. A 2<sup>nd</sup> and different set were received with much anticipation by those using the initial set.

As stated earlier; this project had very little negative results except for the problems caused when the computer crashed at the university site where the website domain exists. The information lost due to the computer going down did not allow us to show the increased views of lessons highlighted on the posters. The main lesson learned through this process was to make sure that files are backed up.

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**Additional Information:**

To view a copy of the 12 individual posters click on the following link:

<http://www.clover.okstate.edu/fourh/aitc/lessons/extras/hom.html>



# Evaluation of Suspected Drought Tolerant Species in Oklahoma

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## Abstract

The ornamental industry in Oklahoma is continually searching for unique species for introduction as a way to sustain and expand the specialty market. An emerging niche is introduction of drought tolerant herbaceous taxa. The objective of this research is to provide the Oklahoma ornamental industry with needed information on drought tolerant species selections. Three pots of 10 seeds from 53 different genera including over 150 species were planted at the Oklahoma State University research greenhouses, of which 77 species from 34 different genera had at least one seed germinate per pot. On 10 May 2011, seedlings were planted in research row plots at the Oklahoma State University research station in Perkins. Plants were watered weekly with drip irrigation for establishment. Oklahoma experienced record setting hot temperatures during the summer of 2011. Species that survived the summer included *Amsonia eastwoodiana*, *Amsonia elliptica*, *Amsonia hubrichtii*, *Amsonia tomentosa*, *Anthyllis vulneraria*, *Asclepias eriocarpa*, *Asclepias hallii*, *Asclepias latifolia*, *Baptisia australis*, *Baptisia bracteata*, *Baptisia lactea*, *Calliandra eriophylla*, *Dalea bicolor*, *Dalea formosa*, *Dalea ornata*, *Dalea pulchra*, *Dalea purpurea*, *Dalea villosa*, *Enceliopsis argophylla*, *Enceliopsis covillei*, *Erysimum* sp., *Euphorbia baselucis*, *Lavendula angustifolia*, *Leucophyllum frutescens*, *Leucophyllum minus*, *Penstemon rostriflorus*, *Penstemon cyananthus*, *Penstemon pinifolius*, *Poliomintha incana*, *Salvia dorrii*, *Salvia pachyphylla*, *Thermopsis rhombifolia*, *Trifolium rubens*. The only species to flower and survive the first summer from seed was *Dalea bicolor*. Plants will be evaluated for winter hardiness during spring 2012.

## Materials and Methods

Seeds of various genera and species were obtained from Plant World Seeds (Devon, U.K.) and Alplains (Kiowa, CO) in March, 2011 (Table 1 and 2; Fig. 1-11). Number of seeds per pot varied depending on seed source and each species had three replications. Seeds were either scarified, stratified, scarified and stratified, or just planted depending on germination instructions. Scarification treatments consisted of rubbing seeds once down a 15-cm (6-in) #320-grit aluminum oxide Emory cloth (3M Company, St. Paul, Minnesota). Seeds to be stratified were planted near the surface in moist Redi-earth Plug and Seedling Mix (SunGro Horticulture, Bellevue, WA) located in standard 6 inch (15.24 cm) pots each with 0.35 kg of medium and then placed in a cooler for 6 or 8 weeks at 4 °C (39 °F). All seeds were lightly covered with media to a depth of 1.3-cm (0.5-in). After stratification and scarification treatments, all seeds were placed in the greenhouse at 20 °C (68 °F) on 25 March, 2011. Seedlings were transplanted into research plots at the Oklahoma State University Research Station in Perkins, OK (USDA hardiness zone 7a) May, 2011. Drip irrigation was used as needed to help establish the plants the first year. Plants were planted on one foot spacings. Data collected included summer survival, flowering, plant height and width data in September, and winter hardiness data in May, 2012.



Fig. 5. *Verbascum* 'Cottage Dream'



Fig. 6. *Sphaeralcea parvifolia*



Fig. 7. *Glaucium flavum*

Table 1. Results of seed germination, summer survival, and winter hardiness from a selected group of plants from Plant World Seeds being evaluated for ornamental merit and drought tolerance.

Species <sup>z</sup>	No. of seeds <sup>y</sup>	No. of seedlings	Survive 1 <sup>st</sup> summer <sup>x</sup>	Height <sup>w</sup> (cm)	Width <sup>w</sup> (cm)	Flower 1 <sup>st</sup> year	Survive 1 <sup>st</sup> winter
<i>Alonsoa</i> 'Pink Beauty'	150	9	no	n/a	n/a	n/a	n/a
<i>Alonsoa incisifolia</i>	125	10	no	n/a	n/a	n/a	n/a
<i>Anomatheca laxa</i>	18	4	no	n/a	n/a	n/a	n/a
<i>Anthyllis vulneraria</i> v. <i>coccinea</i>	15	5	yes	1.4	5.3	no	no
<i>Dierama species mixed</i>	32	30	yes	4.7	6.1	no	yes
<i>Echium</i> 'Blue Steeple'	30	15	yes	6.1	11.3	no	no
<i>Echium</i> 'Pink Fountain'	35	20	yes	4.7	13.8	no	no
<i>Echium</i> 'Snow Tower'	75	50	yes	18.2	22.1	no	no
<i>Echium italicum</i> 'White'	25	4	yes	2.6	13.5	no	yes
<i>Epilobium dodonaei</i>	115	4	no	n/a	n/a	n/a	n/a
<i>Erysimum</i> 'Plant World Rainbows'	8	2	yes	5.6	10.9	no	yes
<i>Eucomis reichenbachii</i>	13	10	no	n/a	n/a	n/a	n/a
<i>Euphorbia baselucis</i>	8	4	yes	9.3	14.4	no	yes
<i>Kniphofia</i> mixed species	50	1	no	n/a	n/a	n/a	n/a
<i>Lavendula angustifolia</i>	140	40	yes	4.5	5.3	no	yes
<i>Lavendula</i> 'Van Gogh's Babies'	28	6	yes	13.2	15.5	no	yes
<i>Lobelia bridgesii</i>	50	4	no	n/a	n/a	n/a	n/a
<i>Schizostylis coccinea</i> v. <i>major</i>	100	30	no	n/a	n/a	n/a	n/a
<i>Schizostylis</i> mixed colors	40	13	no	n/a	n/a	n/a	n/a
<i>Sisyrinchium</i> choice hybrids	230	60	no	n/a	n/a	n/a	n/a
<i>Sisyrinchium palmifolium</i>	200	7	no	n/a	n/a	n/a	n/a
<i>Tropaeolum</i> 'Ladybird Cream Purple Spot'	9	9	no	n/a	n/a	n/a	n/a
<i>Tropaeolum</i> 'Empress of India'	16	16	no	n/a	n/a	n/a	n/a
<i>Verbascum</i> 'Cottage Garden'	300	15	yes	12.2	17.7	no	yes

<sup>z</sup>Seeds were bought from Plant World Seeds ([www.plant-world-seeds.com](http://www.plant-world-seeds.com)) and planted in the greenhouse on 25 March 2011.

<sup>y</sup>Number of seeds per pot with three pots per species. All seeds were just planted except for *Kniphofia* sp. in which the seeds were scarified with sandpaper. Plants were field planted on 11 May 2011.

<sup>x</sup>Hottest summer on record for Oklahoma with temperatures averaging of 87 °F from June through August, 2011.

<sup>w</sup>Based on a single plant.



Fig. 1. *Dalea bicolor* v. *argyrea*



Fig. 2. *Echium tuberculatum*

## Introduction

Herbaceous ornamental plants continue to increase in popularity for use in private gardens and commercial landscapes in Oklahoma and across the United States (Ault, 2003). These plants are part of the 5 billion dollar floriculture market (Jerardo, 2003). Within the perennial market, consumer demand for drought tolerant plants has increased due to invasive plant and water conservation issues (Ault, 2003), and is considered an emerging niche market in the green industry (Brzuszek et al., 2007). Benefits of using drought tolerant taxa include the potential for reduced water, fertilizer, and maintenance.

Consumer demands for new drought-tolerant species to fit their landscape needs is driven by those specialty nurseries that sell or focus on introducing new drought tolerant plant sections every year. Sunshine Nursery (Clinton), Bustani Plant Farm (Stillwater), and Greenleaf Nursery (Tahlequah) are some examples of such nurseries in Oklahoma. Unfortunately, information is limited on drought tolerant species adaptability. There are a number of genera and species that have potential for commercialization but are only cultivated on a limited level as they have not been evaluated for adaptability to a specific region, growth habit, flowering characteristics, and pest or disease problems (Fehr, 1991; Thomas and Schrock, 2004). Environmental conditions in Oklahoma favor development and evaluation of herbaceous, ornamental, and bulb producing taxa for drought tolerance along with regional adaptability for winter hardiness traits.



Fig. 3. *Euphorbia baselucis*



Fig. 4. *Amsonia hubrichtii*

Table 2. Results of seed germination, summer survival, and winter hardiness from a selected group of plants from Alplains being evaluated for ornamental merit and drought tolerance.

Species <sup>z</sup>	Seed treatment <sup>y</sup>	No. of seedlings <sup>x</sup>	Survive 1 <sup>st</sup> Summer <sup>w</sup>	Height <sup>w</sup> (cm)	Width <sup>w</sup> (cm)	Flower 1 <sup>st</sup> year	Survive 1 <sup>st</sup> winter
<i>Amsonia eastwoodiana</i>	8 wk strat	7	yes	7.4	16.1	no	yes
<i>Amsonia elliptica</i>	8 wk strat	2	yes	5.7	8.3	no	yes
<i>Amsonia hubrichtii</i>	6 wk strat	1	yes	8.3	12.2	no	yes
<i>Amsonia peeblesii</i>	6 wk strat	8	no	n/a	n/a	n/a	n/a
<i>Amsonia tomentosa</i>	8 wk strat	5	yes	8.5	8.3	no	yes
<i>Asclepias asperula</i>	6 wk strat	9	no	n/a	n/a	n/a	n/a
<i>Asclepias cordifolia</i>	6 wk strat	1	no	n/a	n/a	n/a	n/a
<i>Asclepias cryptoceras</i>	scar + 6 wk strat	9	no	n/a	n/a	n/a	n/a
<i>Asclepias eriocarpa</i>	6 wk strat	9	yes	6	11	no	yes
<i>Asclepias hallii</i>	6 wk strat	8	yes	3.1	4.9	no	yes
<i>Asclepias latifolia</i>	6 wk strat	10	yes	10.8	13	no	yes
<i>Asclepias solanoana</i>	scar + 6 wk strat	9	no	n/a	n/a	n/a	n/a
<i>Asclepias tuberosa</i>	6 wk strat	9	yes	5.5	9.5	no	yes
<i>Baptisia australis</i>	just planted	4	yes	25.5	13.4	no	yes
<i>Baptisia bracteata</i>	just planted	3	yes	1.6	5.6	no	yes
<i>Baptisia lactea</i>	just planted	4	no	n/a	n/a	n/a	n/a
<i>Bonardia glaberrima</i>	just planted	1	no	n/a	n/a	n/a	n/a
<i>Calliandra eriophylla</i>	just planted	4	yes	13.5	17.5	no	no
<i>Dalea bicolor</i> v. <i>argyrea</i>	just planted	6	yes	21.6	37.1	yes	yes
<i>Dalea formosa</i>	just planted	3	yes	7.8	18	no	yes
<i>Dalea ornata</i>	just planted	3	yes	2.4	2.5	no	yes
<i>Dalea pulchra</i>	just planted	8	yes	23.2	28	no	yes
<i>Dalea purpurea</i>	scarified	1	yes	8.6	13.5	no	yes
<i>Dalea thompsonae</i>	scarified	2	no	n/a	n/a	n/a	n/a
<i>Dalea villosa</i>	scarified	1	yes	4	4.4	no	yes
<i>Enceliopsis argophylla</i>	just planted	5	yes	6.8	10.2	no	yes
<i>Enceliopsis covillei</i>	just planted	6	yes	2	3.7	no	no
<i>Enceliopsis nudicaulis</i>	just planted	3	no	n/a	n/a	n/a	n/a
<i>Ephedra minima</i>	just planted	1	no	n/a	n/a	n/a	n/a
<i>Ephedra viridis</i>	6 wk strat	8	no	n/a	n/a	n/a	n/a
<i>Heuchera hallii</i>	just planted	1	no	n/a	n/a	n/a	n/a
<i>Heuchera parviflora</i> v. <i>nivalis</i>	just planted	3	no	n/a	n/a	n/a	n/a
<i>Heuchera pulchella</i>	just planted	1	no	n/a	n/a	n/a	n/a
<i>Heuchera rubescens</i> v. <i>versicolor</i>	just planted	1	no	n/a	n/a	n/a	n/a
<i>Leucophyllum frutescens</i>	just planted	4	yes	15.6	17.6	no	no
<i>Leucophyllum minus</i>	just planted	2	yes	14.3	11.6	no	yes
<i>Poliomintha incana</i>	just planted	6	yes	12.6	15.9	no	no
<i>Sphaeralcea ambigua</i>	scar + 6 wk strat	3	yes	13.4	6.7	no	yes
<i>Sphaeralcea gierischii</i>	scar + 6 wk strat	2	yes	7.2	6.3	no	yes
<i>Sphaeralcea munroana</i>	scar + 6 wk strat	2	yes	5.5	5.2	no	yes
<i>Sphaeralcea parvifolia</i>	scar + 6 wk strat	3	yes	13.1	6.8	no	yes
<i>Stachys coccinea</i>	just planted	2	no	n/a	n/a	n/a	n/a
<i>Zinnia acerosa</i>	just planted	4	no	n/a	n/a	n/a	n/a
<i>Zinnia grandiflora</i>	just planted	5	no	n/a	n/a	n/a	n/a
<i>Thermopsis rhombifolia</i>	just planted	3	yes	7.1	5.9	no	no
<i>Salvia dorrii</i> v. <i>carnosa</i>	just planted	1	yes	6.5	8.4	no	yes
<i>Salvia dorrii</i> v. <i>dorrii</i>	just planted	1	yes	8.4	5.8	no	yes
<i>Salvia mohavensis</i>	just planted	3	no	n/a	n/a	n/a	n/a
<i>Salvia pachyphylla</i>	just planted	5	yes	5.7	6.8	no	yes
<i>Penstemon ambiguus</i>	just planted	2	no	n/a	n/a	n/a	n/a
<i>Penstemon cardinalis</i>	8 wk strat	2	no	n/a	n/a	n/a	n/a
<i>Penstemon clevelandii</i> v. <i>comatus</i>	8 wk strat	2	no	n/a	n/a	n/a	n/a
<i>Penstemon cyananthus</i>	12 wk strat	1	yes	15.1	14.6	no	yes
<i>Penstemon rostriflorus</i>	8 wk strat	1	yes	4	3.5	no	no
<i>Silene delavayi</i>	6 wk strat	4	no	n/a	n/a	n/a	n/a

<sup>z</sup>Seeds were bought from Alplains (Kiowa, CO) and planted in the greenhouse on 25 March 2011.

<sup>y</sup>Strat = stratified or scar = scarified with sandpaper.

<sup>x</sup>Mean number of seedlings after planting 10 seeds per pot with three pots per species. Plants were field planted on 11 May 2011.

<sup>w</sup>Hottest summer on record for Oklahoma with temperatures averaging of 87 °F from June through August.

<sup>w</sup>Based on a single plant.

## Results and Discussion

•Germination rates were less than half for 67% of the species in this study, which was the result of nonviable seeds or lack of efficient seed treatment.

•54% of plants planted in the field survived the first summer, which was the hottest summer on record in Oklahoma (Table 1 and 2).

•Only 1 plant, *Dalea bicolor* v. *argyrea*, flowered the first year.

•77% of the plants that survived the summer also survived the mild winter of 2011-2012 (bold species in Table 1 and 2).

•The plants that are still alive will be further evaluated for two more year to determine ornamental merit under Oklahoma conditions.



Fig. 8. *Asclepias incarnata*



Fig. 9. *Salvia pachyphylla*

## Acknowledgements

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Fig. 10. *Leucophyllum frutescens*

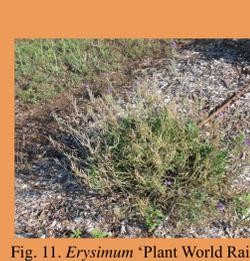


Fig. 11. *Erysimum* 'Plant World Rainbow'

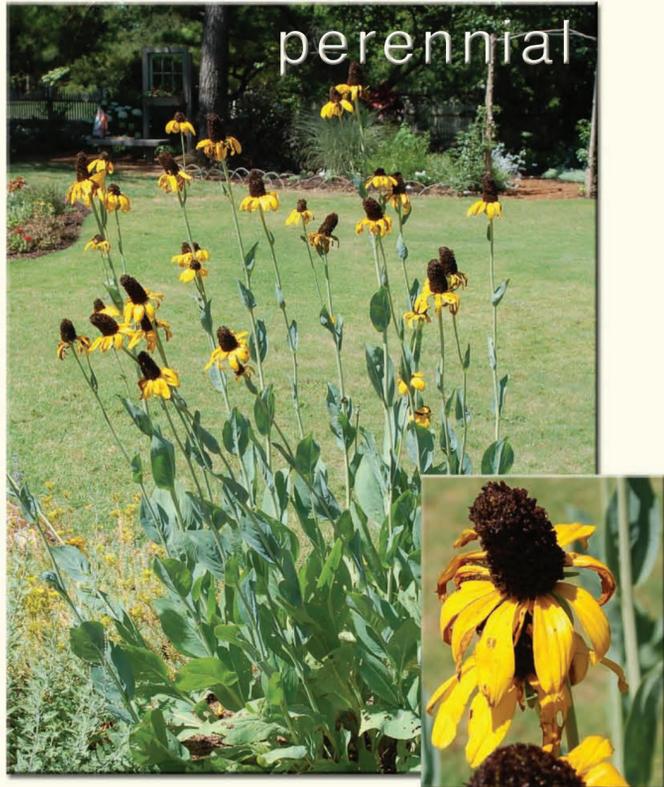


# OKLAHOMA PROVEN!

## Selections for 2011...



**Pink Crystals Ruby Grass**  
*Melinus nerviglumis* 'Savannah'



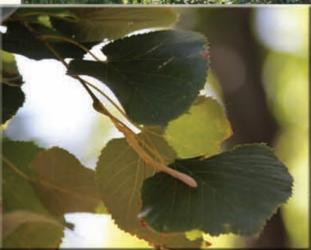
**Giant Coneflower**  
*Rudbeckia maxima*



**Abelia Collection**  
*Abelia x grandiflora*

'Kaleidoscope', 'Little Richard', 'Rose Creek'

Sponsored by:



**Silver Linden**  
*Tilia tomentosa*

**COLLECTOR'S CHOICE** is a recommendation made with adventuresome gardeners in mind. It is a plant that will do well in Oklahoma, may need special placement or a little extra care, but will be rewarding and impressive in the garden.



**American Elm Collection**  
*Ulmus americana*

'New Harmony', 'Princeton', 'Valley Forge'

Photos by Lou Anella, David Hillock



# OKLAHOMA PROVEN SELECTIONS FOR 2011



## Collector's Choice

### Silver Linden

*Tilia tomentosa*

Silver linden is a beautiful large shade tree that can grow 50' to 70' tall. It is quite tolerant of high pH soils and urban conditions and is more heat tolerant than other lindens making it a great street or shade tree for large yards in Oklahoma. Leaves of silver linden are dark green on the upper surface and silvery beneath, providing an interesting effect when the wind blows; leaves can have a nice yellow fall color. Tiny, fragrant, white, flowers attract bees in late June to July. Cultivars selected for brilliant fall color as well as outstanding performance are available.

- Exposure: Full sun
- Soil: Prefers moist, well-drained soil; tolerant of high pH soils and pollution
- Hardiness: USDA Zone 4-7



Photos by David Hillock



# OKLAHOMA PROVEN SELECTIONS FOR 2011



## TREE

### American Elm Collection

*Ulmus americana* ‘New Harmony’,  
‘Princeton’, and ‘Valley Forge’

With the release of improved, disease resistant American elms, they are once again in demand. ‘Valley Forge’, ‘New Harmony’, and ‘Princeton’ are a few of the cultivars available today. ‘Valley Forge’ is upright, arching, broadly vase-shaped with a full, dense canopy. ‘New Harmony’ develops into a broad vase-shaped crown with arching branches terminating in numerous slender, often drooping branchlets. ‘Princeton’ is also vase-shaped. American elms are adapted to a wide variety of soil conditions, tolerate deicing salts, air pollution, drought, and a range of soil pH. They have yellow fall color.

- Exposure: Full sun to part shade
- Soil: Prefers well-drained soil
- Hardiness: USDA Zone 5-9



Photo by Lou Anella



# OKLAHOMA PROVEN SELECTIONS FOR 2011



## Abelia Collection

*Abelia x grandiflora* ‘Kaleidoscope’,  
‘Little Richard’, and ‘Rose Creek’

Several new, compact forms of glossy abelia are becoming very popular. ‘Kaleidoscope’ grows 2-3’ high and slightly wider. In spring leaves appear on bright red stems with lime green centers and bright yellow edges, but variegation does not scorch or burn in hot weather, and in fall color deepens to shades of orange and fiery red. Soft pink flower buds open to white in late spring. ‘Little Richard’ is 3’x3’, evergreen, with vivid green leaves in summer, taking on a tangerine-pink color in fall; white flowers bloom from summer to first frost. ‘Rose Creek’ grows 2-3’ high and 3-4’ wide; is evergreen, with crimson stems. New leaves have a pinkish cast, maturing to lustrous dark green, and turn purple in cold weather. Small white flowers are surrounded by persistent rosy pink sepals. Use these abelias in containers, as formal or informal hedges, accent plants, in mass plantings, or in foundation plantings under windows. Abelias also attract hummingbirds and butterflies to the garden.

- Exposure: Sun to part shade
- Soil: Moist, well-drained, acidic
- Hardiness: USDA Zone 6-9, evergreen in 7 and warmer

## SHRUB

Kaleidoscope  
foliage



‘Little Richard’

Photos by David Hillock



# OKLAHOMA PROVEN SELECTIONS FOR 2011



## PERENNIAL

### Giant Coneflower

*Rudbeckia maxima*

Giant coneflower is native to eastern Oklahoma, but does well throughout the state. It is tolerant of moist soils and is quite drought tolerant once established. Giant coneflower has silvery-blue foliage. Flowers have bright yellow ray flowers that dangle from a large, upright, dark brown cone on stems that reach 5-6 feet high. Giant coneflower blooms in early summer but deadheading the spent blossoms will encourage another flush of blooms in late summer. Plant in masses for best effect. Can be used in mixed borders, meadows, native gardens, and open woods. This species makes a strong vertical statement in the landscape.

- Exposure: Sun, part shade
- Soil: Moist, well-drained
- Hardiness: USDA Zone 4-8



Photos by David Hillock



# OKLAHOMA PROVEN SELECTIONS FOR 2011



## ANNUAL



Photos by David Hillock

### Pink Crystals Ruby Grass *Melinus nerviglumis* 'Savannah'

Pink Crystals Ruby Grass is a warm season grass that likes it hot and performs best in those conditions. Growing only 18 to 22" tall, it is an attractive ornamental grass with blue green foliage and ruby-pink blooms with glistening silky hairs in late spring. Flowers retain their color even when dried and may be used for cut flower arrangements. Pink Crystals Ruby Grass is excellent in beds, borders, and is spectacular in a container planting.

- Exposure: Full sun to part shade
- Soil: Well-drained
- Hardiness: Use as an annual

