Annual report to

FLORICULUTRE NURSERY RESEARCH INITIATIVE

and

UNITED STATED DEPARTMENT OF AGRICULULTURE
AGRICULTURAL RESEARCH SERVICE

for the period of

APRIL 2010 TO MAY 2011

PROJECT

Evaluation of locally available resources for use as alternative soil-less substrates in container-grown plant production for the Great Plains region of the United States.

PRINCIPLE INVESTIGATORS:

Cheryl R. Boyer, Ph.D.
Assistant Professor and Extension Specialist, Ornamental Nursery Crops
Department of Horticulture, Forestry and Recreation Resources
K-State Research and Extension
3601 Throckmorton Plant Sciences Center, Manhattan, KS 66506-5507
Phone: (785) 532-3504 Cell: (785) 320-0066 Fax: (785) 532-5780
Email: crboyer@k-state.edu http://www.hfrr.ksu.edu

James Altland, Ph.D.
Research Horticulturist, USDA-ARS
Application Technology Research Unit
208 Ag. Engineering Bldg.
1680 Madison Ave.
Wooster, OH 44691
voice: 330-263-3870
fax: 330-263-3953
email: james.altland@ars.usda.gov

SYNOPSIS

Situation: There is no local source for pine bark in Kansas thus pine bark for container-grown plant production must be shipped, typically from Texas or Arkansas to growers in the Great Plains region. This added expense might be prohibitory to many growers or at least may place growers at a competitive disadvantage when selling wholesale. Overcoming the shortage of substrate material could greatly increase the acreage of container production of nursery crops in the Great Plains and therefore increase overall gross sales of the Nursery and Greenhouse industry.

Eastern Redcedar has become a nuisance plant to many landowners across the region. Once held back by grazing and wild fires from fully entering the grasslands of the Great Plains, community development and farming have reduced these natural control measures. Additionally, the use of the species in windbreaks, for erosion control, and wildlife cover since the 1960's has increased the seed population. Although regular burning can easily control young plants, established trees are difficult to control. In many cases the only option is to hire a contractor to cut the trees, grind them, and haul away the chips. The resulting mountains of chips are then sold as landscape mulch. This, however, is a very expensive endeavor for the landowner and is often not done. As a result, Eastern Redcedar continues its march across open lands within Kansas. Any means by which the landowner could recoup some of their expense would be a welcome addition.

Program Effort: In Year 3 (2010) We conducted 4 studies in 2010-2011. These studies continued to focus primarily on Eastern Redcedar (*Juniperus virginiana*) as the local materials source, although we evaluated Osage Orange (*Maclura pomifera*) also. The first study was a late-Spring greenhouse-grown annuals project. We varied ratios of peat and 3/16-inch Redcedar (our smallest hammer mill screen size;) with a consistent 25% perlite in all treatments except 100% Redcedar. Three annual bedding plant crops were grown including Petunia (*Petunia* x *hybrida* 'Suncatcher White'), New Guinea Impatiens (*Impatiens hawkeri* 'Celebrette Lavender') and Vinca (*Catharanthus roseus* 'Pacifica Apricot XP'). The second study continued our outdoor crop evaluations. We evaluated 2 trees, 2 shrubs, and 2 perennials in substrates composed primarily of Redcedar processed to various screen sizes (3/4-, ½-, 3/8-, and 3/16-inch Redcedar) with a pine bark control treatment. Species tested included Baldcypress (*Taxodium distichum*), Redbud (*Cercis canadensis*), Crapemyrtle (*Lagerstroemia indica* 'Arapaho'), Spirea (*Spiraea japonica* 'Little Princess'), Maiden Grass (*Miscanthus sinensis* 'Graziella') and Black-eyed Susan (*Rudbeckia fulgida* var. fulgida). We concurrently conducted an identical study using these treatments and species with Osage Orange as the substrate rather than Redcedar (3rd study). The 4th study examined the effect of Redcedar as a propagation substrate using cuttings from Chrysanthemum (*Chrysanthemum* x *morifolium* 'Abelle'), Ivy Geranium (*Pelargonium* 'GerIV Colorcade Cherry Red'), Hibiscus (*Hibiscus rosa-sinensis*), Privet (*Ligustrum* x *vicaryi* 'Golden vicary') and Green Giant Arborvitae (*Thuja* 'Green Giant').

Additionally this year, I created a website to showcase the alternative substrate work funded by FNRI. The URL is www.SustainableSubstrates.com. Here you can find our researcher profiles, compilations of all of our written work (refereed, trade, etc.), slide sets, and links to upcoming learning opportunities.

Results and Impacts: The greenhouse-grown annual project demonstrated that, similar to other projects with wood-based substrates, high percentages of Redcedar do not perform well. Despite careful watering to a 30% leaching fraction, treatments containing more than 25% Redcedar were stunted and chlorotic. Interestingly, water was available in the bottom of the 4-inch containers, but liners were not able to grow enough to reach the water before production was compromised. It is possible that cyclic irrigation may be able to overcome this barrier and we plan to conduct a study in 2011-2012 to evaluate this idea.

Studies #2 and #3 were more promising. Most of the treatments produced plants of marketable quality for trees, shrubs and perennials. Plant size and shoot dry weight decreased significantly with increasing Redcedar particle size. We continue to see that physical properties of substrates composed completely of Redcedar are not ideal for production of nursery crops. Redcedar may perform best as a pine bark extender rather than a complete replacement since blends seem to provide the best plant growth. In these two studies, an unexpected result for shrinkage occurred when comparing Redcedar and Osage Orange: shrinkage was most pronounced in Osage Orange. This is somewhat of a surprise since Osage Orange is known as a strong, long-lived, decay-resistant wood and has been traditionally used for fence posts. It appears that Osage Orange may break down in a container faster than Redcedar which may render it an unattractive alternative substrate.

pH is high (6.0 to 7.5) in Redcedar substrates, but the water source at the John C. Pair Horticultural Research Station in Haysville, KS also has a high pH. By the conclusion of the outdoor studies, pine bark substrates had pH similar to Redcedar. Electrical conductivity was fairly similar among all treatments.

The 4th study of the year evaluated Redcedar as a propagation substrate for several plant species, both softwood and hardwood cuttings. Shoot and root dry weights for all species were similar, demonstrating that Redcedar has a potential use in the propagation industry. However, root morphology of plants grown in high concentrations of Redcedar was different, they were shorter and wider than those grown in perlite. This may demonstrate an adaptive response to propagation in Redcedar and we will continue to pursue this idea in future projects.

INSTITUTIONAL COOPERATORS:

Jason J. Griffin
Associate Professor, Kansas State University
jgriffin@ksu.edu
John C. Pair Horticultural Center
1901 East 95th Street South
Haysville, KS 67060-8351
Ph #: (316) 788-0492
Fax (316) 788-3844

Kimberly A. Williams | Professor, Horticulture
Kansas State University | Dept. Horticulture, Forestry, and Rec. Res.
2021 Throckmorton Hall | Manhattan, KS 66506-5506
785/532-1434 | fax 785/532-6848
www.hfrr.ksu.edu | www.hightunnels.org | www.ksre.ksu.edu/poinsettias

Stu Warren
Professor and Head
Kansas State University
Department of Horticulture, Forestry, and Recreation Resources
2021 Throckmorton Plant Sciences Center
Manhattan, Kansas 66506
E-mail: slwarren@ksu.edu
Phone: 785-532-3365
Fax: 785-532-6949

INDUSTRY COOPERATORS

Robert Cutright
Loma Vista Nursery
1107 East 23rd Street
Ottawa, KS 66067
Cell- 913-915-1929
Office- 785-229-7204 ext 125
Fax- 785-229-7205
rc@lomavistanursery.com

STUDENT INVOLVMENT

Graduate

Z. Starr, MS; Horticulture, Forestry and Recreation Resources (HFRR), K-State, 2009 to present
J. Pool, MS; HFRR, 2009 to present
B.M. Morales Rivera, MS: HFRR, 2010 to present
T. Carmichael, MS; HFRR, 2011 to present
M. Wilson, Ph.D.; HFRR, 2011 to present

Undergraduate

D. Huber, undergraduate student assistant, Fall 2010 to present, Kansas State University

PUBLICATIONS: CONFERENCE PROCEEDINGS

Starr, Z.W., C.R. Boyer, and J.J. Griffin. 2011. Cedar substrate particle size affects growth of container-grown *Rudbeckia*. Proc. Southern Nurs. Assoc. Res. Conf. (In Press)

Starr, Z.W., C.R. Boyer, and J.J. Griffin. 2010. Growth of *Pistacia chinensis* in a cedar amended substrate. Proc. Intl. Plant Prop. Soc. (In Press)

ABSTRACTS

Boyer, C.R., J.E. Altland, J.S. Owen, Jr. 2011. SustainableSubstrates.com: An extension outreach tool. HortScience (In Press).

Starr, Z.W., C.R. Boyer, and J.J. Griffin. 2011. Propagation of chrysanthemum and ivy geranium in redcedar substrate. HortScience (In Press).

Starr, Z.W., C.R. Boyer and J.J. Griffin. 2011. Alternative nursery substrates for the Great Plains: *Maclura pomifera*. HortScience (In Press).

PRESENTATIONS

"Cedar substrate particle size affects growth of container-grown *Rudbeckia*." (Z. Starr) Southern Nurseryman's Association Research Conference, January 2011. Mobile, AL.

"Developing Local, Sustainable Substrate Resources for the Great Plains." (C. Boyer) Horticulture Research Institute Alternative Substrates Conference, January 2011. Mobile, AL.

DOLLARS LEVERAGED - $6,000

Miller, F.L., R.J. Whitworth, E. DeWolf, W. Upham, C.R. Boyer, B. McCornack, L.L. Buschman, W.T. Schapaugh Jr., C.M. Smith, and T.W. Phillips. 2010. Extension IPM coordination in Kansas. USDA NIFA: Extension IPM Coordination and Support Program. 3 years. $273,119. Year 1: $91,040. Boyer portion: $6,000.

GRANTS NOT-AWARDED

Fain, G., J. Altland, J. Owen, C. Boyer, E. Blythe, C. Gilliam, S. Leavengood, C. Landgren, T. Rinehart, C. Seavert, D. Sullivan, and G. Wehtje. 2011. Development of cost effective, renewable and regional substrates for production of containerized specialty crops. NIFA Specialty Crops Research Initiative. 5 years. Total request: $4,183,871; Boyer portion: $316,101.