Final Report to the OSU Water Center
OAES/OCES Water Grants Program

Project Title: Enhancing the OSU Bixby Research Station to Conduct Turfgrass Drought Resistance Research and Extension Programming

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Project Period: January 1, 2014 to June 30, 2015

Descriptors: Turfgrass, Irrigation, Drought, Water Conservation, Agriculture Experiment Station, Field and Research Services Unit, Bixby, OK, Vegetable Research Station

Publications: None

Goal: The goal of this project is to promote water conservation and urban environmental sustainability through the development, commercialization, marketing, and use of improved grass varieties in Oklahoma. We hypothesize that there are significant differences among Oklahoma State University (OSU) experimental bermudagrass selections in terms of drought resistance.

Objectives: Working with Oklahoma turfgrass industry leaders we have identified the following research and extension objectives:

1. Develop the FRSU Bixby Research Station to conduct turfgrass drought resistance research.
2. Conduct drought resistance screening of OSU experimental turfgrass selections for improved drought performance against industry standards and establish turfgrass drought extension demonstration plots.
3. Conduct turfgrass extension field days and workshops for the OK turfgrass industry, OK sod producers, Extension Educators, and Master Gardeners and develop an OCES turfgrass sod production fact sheet.

Students involved in the project.

Student Status	Number	Disciplines
Undergraduate	2	Horticulture and Ag Comm/Ag Business
M.S.	2	Horticulture
Ph.D.	1	Crop Science
Post Doc	1	Horticulture
Total	6	

Background and Rationale: Approximately 50 million acres of land are managed as turf in the form of residential lawns, athletic fields, golf courses, highway roadsides, cemeteries, and parks with an annual estimated value of $57.9 billion (Haydu et al., 2006). Currently, there are about three times more acres of lawn (including residential and commercial) than irrigated corn (Milesi et al., 2005). This makes turfgrass the single largest irrigated "crop" in the U.S. in terms of surface area. Due to the recent droughts of late 2010 through mid-2013, municipalities are treating and delivering more water than ever. The result of the recent droughts has been increased need and use of supplemental irrigation water for outdoor water use and landscape management. As urban and suburban sprawl increases in Oklahoma, large areas of previously non-irrigated pasture and/or croplands are being converted to irrigated homeowner and commercial landscapes. The consequential increase in irrigated turfgrass areas across Oklahoma will result in increased outdoor water use. Therefore, there is a need to release drought resistant turfgrass cultivars and educate Oklahoma citizens of improved cultivars and proper irrigation management practices.

There is currently available research ground at the FRSU Bixby Research Station that could be for turfgrass research plots. The Bixby Station is conveniently located near several OK turfgrass sod producers. The Bixby Station could serve as a prime location for turfgrass drought resistance research and extension activities due the availability of sandy/silt loam soil types and its proximity to OK turfgrass sod producers.

Breeding and Development Program: To date, the major objective of the OSU Bermudagrass Development Team has focused on development, selection, and use of improved varieties. More specifically, the team has focused on the development, selection and use of bermudagrasses showing improved cold hardiness while maintaining acceptable forage yield or turf quality (Taliaferro et al., 2004). For instance, an old, standard variety co-developed by the OSU scientists, Midland, was released in 1953 and exhibited improved cold tolerance compared to 'Coastal' bermudagrass. More recently, an improved variety 'Midland 99' was co-developed by OSU scientists and released in 1999. 'Midland 99' has improved cold tolerance as well as high forage yield and quality, good stand persistence, and is adapted farther North than most bermudagrasses. The improvements in winter hardiness, yield, and quality have allowed producers and ranchers a broader range of use for bermudagrasses while increasing animal gains. In addition, improved turf sod cultivars such as 'Patriot' (2002) and most recently 'NorthBridge' and 'Latitude 36' (both in 2010) were selected specifically for sod strength, turf quality, and winter hardiness (Wu et al., 2009). According to work by Su et al. (2013), 'Latitude 36' and 'NorthBridge' have improved drought tolerance versus other bermudagrass varieties, but did not perform as well as 'Celebration' which shows improved drought resistance in Oklahoma mostly due to its ability to avoid drought via superior root growth. However, for Oklahoma, both 'Latitude 36' and 'NorthBridge' have significantly improved cold hardiness compared to 'Celebration', making it a better choice to grow in Oklahoma and survive Oklahoma winters. Also, 'Latitude 36' was ranked as the top performing grass in the latest National Turfgrass Evaluation Program bermudagrass trials (National Turfgrass Evaluation Program, 2012). Past OSU cultivars have offered sod producers rapid establishment and shorter interval harvest timing compared to other bermudagrasses, thus increasing economic potential and sustainable production. Lastly, much work has been completed concerning management, use, and production of these grasses. However, we must address the critical issues of drought, water

availability, use of alternative water sources (water quality/salt concerns), and overall environmental impact (National Research Council of the National Academies, 2009).

Methods: *Objectives 1 and 2: Develop the FRSU Bixby Research Station to conduct turfgrass drought resistance research. Conduct drought resistance screening of OSU experimental turfgrass selections for improved drought performance against industry standards and establish turfgrass drought extension demonstration plots.*

In early 2014, various meetings were held with Dr. Randy Raper, Director of the OAES FRSU, to begin planning for the establishment of a new irrigation system and turfgrass research and extension plots at the Bixby Vegetable Research Station. In June through July 2014, PI Moss conducted meetings with Jeffrey L. Bruce of the Jeffrey L. Bruce & Company LLC. Jeffrey L. Bruce, is Owner of Jeffrey L. Bruce & Company (JBC). Founded in 1986, Mr. Bruce's accomplishments, commitment, and vision are well documented. He has received over 80 separate design and leadership awards. Award winning projects of his firm, Jeffrey L. Bruce & Company, have been published 150 times. He has been licensed to practice in 26 states and has served as an invited lecturer, visiting critic, and speaker at over 200 conferences and trade shows. In 1996, Mr. Bruce was elected Fellow of the American Society of Landscape Architects. He is President of the American Society of Irrigation Consultants (ASIC) and Chairman of Green Roofs for Healthy Cities (GRHC). Mr. Bruce is a LEED accredited professional, a certified irrigation designer and an EPA WaterSense Certified Professional. He was one of the first accredited Green Roof Professionals (GRP) in North America and is a founding member of the Sports Turf Committee for the National Interscholastic Association of Athletic Administrators. Mr. Bruce is author of the "Integrated Water Management for Buildings and Sites" seminar series for GRHC and ASIC. Jeffrey Bruce's company has worked on various high profile turf projects such as the Carolina Panthers, Detroit Lions, Denver Broncos, Louisiana State University Athletics, the New York Yankees, and the University of Missouri Athletics. Based on his expertise, Jeffrey L. Bruce was hired to design the turfgrass research and extension plots irrigation system for the Bixby Research Station project. In August 2014, Dr. Randy Raper gave approval to proceed and work with Jeffrey L. Bruce & Company. In September 2014, Jeffrey Bruce visited the Bixby Research Station for an initial site visit and information gathering meeting. From September to December 2014, Mr. Bruce worked on the irrigation design and planning for the project.

Working the OAES and Dr. Randy Raper, a new water well was also necessary to provide adequate irrigation water to the new Bixby turfgrass research and extension plot areas. A bidding process was completed in the 4th quarter of 2014 to complete well drilling at various FRSU Research Stations, including Bixby. The new water well at the Bixby site was completed by the contractor in February 2015.

After completion of the water well and after obtaining water yield information for the site, Mr. Bruce finalized the irrigation design in February 2015. After finalization of the irrigation plans, a bidding process was started to contract with an irrigation installation company to install the new irrigation system. The bidding process was initiated near the end of FY 2015. The process irrigation system went out for bids in March/April 2015, but came back at a significantly higher cost than was estimated. It was determined that the irrigation supplies could be purchased

separately through a State contract. Therefore, the irrigation supplies were purchased through the State contract and the irrigation system installation process was re-drafted and went out to bid at the end of FY 2015. However, at the end of FY 2015 through the beginning of FY 2016, OSU converted to a new financial/purchasing system that significantly delayed the bidding process. In addition, the OAES conducted a search for a new OAES Associate Director near the end of FY 2015. Due to these circumstances, progress has been somewhat delayed, however things are moving forward towards completion of the project. The new bid for irrigation installation went out in FY 2016 and the process is still under consideration at the time of this report. It is expected that the irrigation installation will take place through FY 2016 and will be completed by June 30, 2016.

The turfgrass research plots cannot be established until after completion and installation of the new irrigation system. We are currently propagating our experimental bermudagrass lines in the Turfgrass Research Station greenhouse and in field plots located in Stillwater, OK. These grasses will be used to propagate and establish the research plots in Bixby during the summer of 2016. As of the time of this final report, this work is ongoing.

Methods: *Objective 3: Conduct turfgrass extension field days and workshops for the OK turfgrass industry, OK sod producers, Extension Educators, and Master Gardeners and develop an OCES turfgrass sod production fact sheet.*

After successful installation of the new irrigation system and establishment of the extension demonstration drought shelter field plots, we will hold a sod producer and end user field day to disseminate critical information concerning our drought resistance research and proper irrigation practices and efficiencies. We will also conduct train-the-trainer sessions whereby the research and extension team will provide bermudagrass selection, use, production, and management information and proper irrigation methods training to University Extension Educators and Master Gardeners, who will in turn extend the information to their local constituencies. Lastly, an Oklahoma Sod Production fact sheet will be created, published, and distributed at upcoming field days and other OCES events. We plan to complete these task in the summer of 2016.

The following project logic model shows the various inputs, outputs, and outcomes/impacts of this project.

Bixby Project Logic Model

Inputs	**Outputs**		**Outcomes-Impact**		
	Activities	**Participation**	**Short Term**	**Medium Term**	**Long Term**
What we invest	What we do	Who we reach	What the short term results are	What the medium term results are	What the ultimate impact is
Time 2014 Research/Extension Justin Moss Randy Raper Yanqi Wu Dennis Martin Brian Jervis Grad student Undergrad student Producers	Research Testing and identification of cultivars with improved drought resistance Extension Field day Workshop Fact sheet ASA or TPI poster Turf website	Sod producers Oklahoma turf industry Extension Educators Master Gardeners Faculty Scientist USDA representatives Distributors Retailers Sod customers Public	Learning Cultivar selection and management Irrigation management Soil fertility Awareness Proper water use and irrigation Environment Water conservation Plant Need	Action/ Behavior/ Practice Adoption of proper/best cultivar selection and irrigation techniques for sod production in Oklahoma/southern US Decision-making/ Policies	Increased drought resistance in bermudagrasses used for sod production and sales in Oklahoma and the Southern United States. Producer adoption and implementation of best management irrigation practices

John Easton (Easton Sod Farms) Charles Binney (Riverview Sod Ranch) <u>Research Space</u> FRSU - Bixby <u>Funds</u> OAES/OCES <u>Equipment</u> Irrigation Mowers Sod harvester Fertilizer spreader Pesticide sprayer <u>Materials</u> Drought shelters Sod Fertilizer Pesticides Software Sensors	Newspaper articles Trade magazine articles TV – Oklahoma Gardening <u>Teaching</u> Graduate student Undergrad student Turf class		Soil Fertility Public perception <u>Knowledge</u> Irrigation techniques Efficient irrigation technologies Environment Plant Need Soil Fertility <u>Attitudes/Opinions</u> Willingness to change/alter production / cultivar selection strategies Environmental perceptions <u>Skills</u> Proper irrigation Irrigation audits Soil testing <u>Motivations/ Aspirations</u> Financial Public relations Environmental protection Moral	Producers utilize science, reduced water use cultivars, efficient irrigation, soil testing, and plant water needs to irrigate crops properly rather than relying solely on experience and historical use.	to increase bermudagrass sod quality, and mitigate off-site losses of nutrients to the environment while decreasing water and fertilizer inputs. Increased bermudagrass sod producer profits. Agricultural and urban sustainability – Increased profitability and/or reduced risk, Increased water conservation, Improved surface water quality, Healthier environment, Increased sod farm efficiencies, Improved quality of life/increased satisfaction with quality of life.

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