

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Turfgrass Development and Management

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water	15%		10%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		5%	
202	Plant Genetic Resources	7%		10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		10%	
204	Plant Product Quality and Utility (Preharvest)	0%		5%	
205	Plant Management Systems	55%		15%	
206	Basic Plant Biology	0%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	3%		10%	
212	Pathogens and Nematodes Affecting Plants	6%		10%	
216	Integrated Pest Management Systems	14%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	1.5	0.0	2.0	0.0
Actual Paid Professional	2.0	0.0	2.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
45000	0	92109	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
45000	0	92109	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
200000	0	398952	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The turfgrass development and management team continued the breeding and development activities on straight species and interspecific hybrid bermudagrass. Over 750 internal experimental bermudagrass lines were evaluated from our program in 2013 as well as 160 experimental lines each of zoysiagrass, bermudagrass, St Augustinegrass and 80 lines of seashore paspalums were evaluated by our program in a Specialty Crops Research Initiative cooperate 5 state project. We advanced 5 of our lines screened for drought resistance as well as assisted 4 other breeding programs in advancement of their bermudagrass, zoysiagrass, St Augustinegrass and seashore paspalum lines for more intensive testing in 2013 for drought and salinity resistance. This testing and developmental activity will result in turfgrass products that will have improved abiotic and biotic stress resistance/tolerance. We continued research to identify new and refined integrated management practices such as reduced risk herbicides and pesticide adjuvants. Educational materials were developed featuring improved integrated management products and practices. We continued intensive and effective educational programming to audiences in Oklahoma and Arkansas concerning basic and advance turfgrass management practices. Research and extension activities related to improved efficiency of water application and runoff were provided. Rational decision making based on the combination of science, perception and sound public policy are being made by the turf industry and the public at large. Resultant adoption of integrated turfgrass management strategies remains very high (>94%). We anticipate positive environmental impacts are taking place due to our focused research and intensive training efforts.

2. Brief description of the target audience

Audiences include governmental, private industry and multiple end-user areas. Research audiences: basic and applied plant science/turf science researchers, including those from the CSSA, and ASHS. Funding agency audiences: USGA, GCSAA, USDA, OTRF and many private corporations. New cultivars developed as well as products such as trade articles, fact sheets, and educational programming will be provided to the target audiences characterized as the turfgrass production sector (sod and seed producers), service sector (landscape/lawn care and pest control operators) and turf managers (which include the golf course, parks & grounds, right of way managers and home consumers).

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	13805	0	0	0

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012
 Actual: 1

Patents listed

Forage bermudagrass plant named 'Goodwell'.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	3	4	7

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of peer-reviewed journal articles manuscripts submitted

Year	Actual
2012	8

Output #2

Output Measure

- Number of final stage experimental bermudagrasses sent to national testing phase in the NTEP bermudagrass trial
 Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of turf/roadside vegetaion management workshops conducted

Year	Actual
2012	33

Output #4

Output Measure

- Number of turfgrass managers trained in improved varieties and integrated turfgrass management systems

Year	Actual
2012	1753

Output #5

Output Measure

- Experimental turfgrass lines screened for drought resistance

Year	Actual
2012	560

Output #6

Output Measure

- Turfgrass diagnostics conducted

Year	Actual
2012	75

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	New varieties appearing in the Oklahoma sod trade for the first time
2	New turf varieties used by the Oklahoma golf course industry
3	Number of turfgrass manager participants intending to adopt improved turf management practices
4	Water conservation and water quality in turfgrass
5	Development of turf bermudagrasses with improved shade tolerance

Outcome #1

1. Outcome Measures

New varieties appearing in the Oklahoma sod trade for the first time

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Since its invention, Tifway hybrid bermudagrass has provided an outstanding lawn and sports field surface in the southern US. Few grasses could rival its visual appeal and functional value. However, Tifway lacks appropriate winter hardiness, so its use across the transition zone (the merger area between subtropical and temperate climate zones) has been limited due to potential of winter kill. A cold hardy hybrid bermudagrass having both the visual and functional characteristics of Tifway yet having superior cold hardiness, has been sought by turfgrass managers for decades. Until recently, only OSU's Patriot hybrid bermudagrass offered quality approaching that of Tifway while having superior cold hardiness.

What has been done

The Oklahoma State University Bermudagrass Breeding and Development Team has been working since 1986 on development of both seeded and vegetatively propagated bermudagrasses having outstanding winter hardiness and improved visual and functional quality. During that time superior cultivars in the form of Yukon, Riviera, and Patriot were developed and released to the turfgrass industry. In 2003 a round of super high quality OSU experimental hybrid bermudagrass lines entered a 9 year trial at Stillwater, OK, going head to head with the industry standard, Tifway. Winter tolerance, quality, color, texture density, sod strength, divot injury and traffic tolerance were assessed during this trial. Two superior lines, OKC1119 and OKC1134 emerged as elite performers against Tifway under Oklahoma conditions and were selected in 2007 for competing in the final stage 5-year long National Turfgrass Evaluation Program bermudagrass test.

Results

The OSU cultivars Latitude 36 (OKC1119) and Northbridge (OKC11134) emerged as top performers in the 2007-2012 multi-state NTEP bermudagrass trial. These lines were licensed to

Sod Solutions, LLC who has since licensed nine sod producers of the OSU products during the 2011 and 2012 time period. In 2012 two sod producers in Oklahoma began production of the two new OSU hybrid bermudagrasses having both visual and functional quality equaling or exceeding Tifway and winter tolerance exceeding Tifway.

As licensed sod producers of Latitude 36 and Northbridge bermudagrass expand their acreage in production, consumers will at last be able to purchase bermudagrass that truly has the traditional visual and functional appeal of Tifway but having cold tolerance exceeding that of Tifway and on par with OSU's Patriot bermudagrass. Transition zone turfgrass managers won't have to play visual appeal against winter hardiness since these characterizes are wrapped into a single package by the name of Latitude 36 and Northbridge bermudagrasses from Oklahoma State University.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #2

1. Outcome Measures

New turf varieties used by the Oklahoma golf course industry

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of turfgrass manager participants intending to adopt improved turf management practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
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2012 1648

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #4

1. Outcome Measures

Water conservation and water quality in turfgrass

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to a survey from the 2000 National Water Quality Inventory of the United States Environmental Protection Agency, 39, 45, and 51% of the rivers, lakes, and estuaries, respectively, in the United States are not clean enough to support uses such as fishing and swimming. One of the major factors that leads to widespread and significant water body problems is eutrophication, which involves a reduction of oxygen in water usually caused by excessive nitrogen (N) and phosphorus (P).

What has been done

The Oklahoma State University Runoff Research Site was completed in 2001 and updated to accept filter materials in 2011. Runoff collection trenches were filled with steel slag, a byproduct of steel manufacture, to test the slag's ability to filter P from runoff. The P concentrations in pre-filtered and post-filtered runoff were compared during 14 simulated and natural runoff events in 2012.

Results

Trench filters filled with steel slag removed and sequestered 19% of the P that entered in runoff. A model developed using flow through tests in a laboratory and verified by data collected from the trench filters suggested that the filters could accept 183 mg kg⁻¹ P before being spent (saturated to the point where they no longer removed P) and would remove 9% of the P added to the filter over the life of the system.

Trench filters filled with steel slag are a reasonably inexpensive means for removing P from surface runoff. Increasing the effectiveness of a filter is simply a measure of increasing the amount of slag added to the filter. With further development and commercialization, trench filters and other slag filters provide a means for removing P from runoff before it enters surface waters.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
205	Plant Management Systems

Outcome #5

1. Outcome Measures

Development of turf bermudagrasses with improved shade tolerance

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Bermudagrass is a very important forage and the most important turfgrass in the southern US. Its massive root and rhizome system provides excellent soil erosion resistance and its fine turf characteristics provide good aesthetic value. It also relatively drought resistant compared with other grasses and can provide a dense perennial cover with or without irrigation. However, it has poor shade tolerance cannot provide aesthetic or functional value on shaded sites.

What has been done

The Oklahoma State University turfgrass team has conducted research concerning light and shade effects on turf for many years. In 2008 we began research to select common bermudagrass varieties that would tolerate low light conditions with the intention of developing improved cultivars for use on moderately shaded sites.

Results

Our development process resulted in three unique bermudagrass lines being advance for late stage testing. Lines OKS-2011-1 and OKS-2011-4 will be entered into the National Turfgrass Evaluation Program (NTEP) Trials in the US for the period 2013 - 2018. Line OKS-2011-3 will undergo further internal development to improve seed yield, fine turf characteristics, and shade tolerance.

Research indicates that OKS-2011-1 and OKS-2011-4 are excellent seed producers in comparison with commercially available fine turf common bermudagrass cultivars and may be made available for licensing to producers as early 2014. Both selections have improved fine turf characteristics and shade tolerance compared with the common bermudagrasses currently available and will provide producers and consumers with improved choices for seeding lawns and other turfgrass areas.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

Severe drought compromised three roadside weed control trials being conducted for the OK Dept of Transportation by our program. Despite the use of water tankers, inadequate water could not be delivered to actual roadside median trials as the drought

continued through year 2. Drought conditions proved highly useful in conducting turfgrass drought resistance screenings on 560 experimental lines of turf bermudagrass, zoysiagrass, seashore paspalum and St. Augustinegrass. Golf course construction remains relatively stagnant in Oklahoma so installation of new varieties is limited as far as new course construction is concerned. Introduction of new or better adapted varieties is principally limited to fall reseeding efforts of creeping bentgrass and the occasional introduction of new bentgrass cultivars. Problems with development of new purchasing contracts for state agencies limits the ability of certain state agencies from purchasing new combination drift control/spreader adjuvants found to provide equal or superior performance to older, more expensive and problematic products.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Participants at our turfgrass short courses, conferences, field days and workshops are surveyed by paper copy for opinions and adoption of integrated turfgrass management (ITM) practices. Overall adoption of the ITM practices as a whole is greater than 94%. ITM includes the use of newer or better adapted turfgrass cultivars/species, more effective and or reduced environmental risk pesticides as well as appropriate or improved timing of existing ITM practices.

Key Items of Evaluation

Written post-educational session surveys. Adoption of new or improved turfgrass cultivars, adoption of an improved management practice, adoption of a new, improved pesticide or adjuvant.