V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Crop Enterprises

☑ 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
102	Soil, Plant, Water, Nutrient Relationships	17%		5%	
133	Pollution Prevention and Mitigation	3%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	9%		20%	
204	Plant Product Quality and Utility (Preharvest)	15%		10%	
205	Plant Management Systems	29%		20%	
211	Insects, Mites, and Other Arthropods Affecting Plants	5%		10%	
212	Diseases and Nematodes Affecting Plants	5%		10%	
213	Weeds Affecting Plants	10%		5%	
215	Biological Control of Pests Affecting Plants	3%		5%	
216	Integrated Pest Management Systems	4%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	18.0	0.0	11.0	0.0
Actual Paid	23.0	0.0	12.4	0.0
Actual Volunteer	1.3	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**
232000	0	621729	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
232000	0	621729	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2731600	0	3081473	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. Wheat cultivar performance testing and demonstration throughout Oklahoma
2. Wheat breeding, variety development, and introgression of new traits into elite germplasm
3. Publication of web sites, web-based updates, video presentations, and printed extension materials that disseminate research findings and address current and emerging issues in Oklahoma agriculture
4. Provide effective, non-classroom educational opportunities for industry professionals, Extension educators, farmers, and ranchers.
5. Conduct on-farm research and demonstration of nitrogen rich strips and use of hand-held sensors.
6. Explore opportunities for market-based solutions to global climate change and evaluate potential for Oklahoma stakeholders to participate in these opportunities
7. Explore opportunities for market-based solutions to global climate change and evaluate potential for Oklahoma stakeholders to participate in these opportunities

2. Brief description of the target audience

Wheat growers, dual-purpose wheat producers, millers, bakers, wheat importers, seed growers and dealers, wheat breeders, crop producers, canola, peanut, sunflower and other crop producers and nutraceutical producers.

3. How was eXtension used?

Dr. Randy Boman is active in the Cotton CoP

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	54940	3074966	100000	1300

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	14	65	79

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Field Demonstrations, field days, and conferences

Year	Actual
2014	97

Output #2

Output Measure

- Regionally adapted wheat cultivars

Year	Actual
2014	0

Output #3

Output Measure

- Educational materials developed

Year	Actual
2014	95

Output #4

Output Measure

- Web-based educational materials such as web sites, videos, and social media applications

Year	Actual
2014	12

Output #5

Output Measure

- Locally-controlled evaluations and agronomic data for small grains crops

Year	Actual
2014	55

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of wheat varieties released to address agronomic and end-use quality needs of the hard red and hard white winter wheat industries.
2	Percentage of wheat acres sown to varieties with improved pest resistance, yield potential, and end-use quality.
3	Number of on-farm demonstrations of nitrogen rich strips and of hand-held sensors
4	Locally-controlled evaluations and agronomic data for small grains crops
5	Improving Resistant Weed Management in Wheat
6	New Herbicide Program Approach for Rescuegrass Weed Control in Wheat Production Systems in Oklahoma
7	Economics of foliar fungicides for hard red winter wheat in the southern Great Plains
8	No-Till Oklahoma Conference
9	Fertilization and economic feasibility of sweet sorghum grown as biofuel feedstock using commercial fertilizer
10	Drought monitoring: a system for tracking plant available soil moisture based on the Oklahoma Mesonet
11	Canola Integrated Pest Management

Outcome #1

1. Outcome Measures

Number of wheat varieties released to address agronomic and end-use quality needs of the hard red and hard white winter wheat industries.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wheat and the associated grazing component are worth in excess of $1.5 billion annually to the Oklahoma economy. In the winter-wheat market, farmer profitability is yield-driven while end-user value is quality driven. While yield potential and end-use quality are not mutually exclusive traits, developing and marketing cultivars that satisfy both requirements is extremely difficult. The fact that there are relatively few scientists and even fewer private companies working in the area of wheat improvement exacerbates the problem.

What has been done
The Oklahoma State University Wheat Improvement Team was developed as a cross-cutting collection of scientists who work collaboratively to develop, test, and distribute improved wheat cultivars for the Southern Great Plains. As part of this effort over 900 individual crosses are made on a yearly basis. In addition approximately 45 cultivars are evaluated in replicated small grain performance trials at 24 sites throughout Oklahoma. Farmers are involved in both of the processes through advisory organizations and direct participation in research trials.

Results
Several advanced experimental lines were tested and considered for release in 2014. The extreme drought, however, was a confounding factor in candidate line evaluation. The experimental line OK09125 showed promise in 2014 and is undergoing additional testing in 2015. In addition, a hard white advanced experimental line OK10728W is being considered for release in 2015. This line shows great adaptability to the northcentral Oklahoma region and a high level of sprouting tolerance. If released, OK10728W could allow Oklahoma farmers to supply some of the 4,000,000 bushels of hard white used in the region.

Wheat varieties released by OSU now occupy 15% (3.2 million) of wheat acres in the southern Great Plains and approximately 6% of the entire US wheat acreage.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #2

1. Outcome Measures

Percentage of wheat acres sown to varieties with improved pest resistance, yield potential, and end-use quality.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	47

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2006 over half (54%) of all wheat acres were sown to the cultivar Jagger or the Jagger-by-Abilene cross Jagalene. In addition, many newer wheat cultivars have offered increased yield as compared to Jagger and Jagalene, but have relied on Jagger resistance genes to fight the problematic foliar diseases leaf and stripe rust. Shifts in disease races over the past four years have made these genes largely ineffective, presenting an unnecessary production risk for farmers and grain merchandisers.

What has been done
Since 2006, the Oklahoma State University Wheat Improvement Team has developed and released ten wheat cultivars with disease resistance and agronomic performance superior to that of Jagger and Jagalene in targeted environments. In addition, our newest releases and advanced experimental lines contain insect and disease resistance genes different from those in Jagger. A comprehensive educational campaign has made farmers and ranchers aware of improved

cultivars released by land-grant institutions and private breeding companies in the region.

Results
In 2012 acreage of Jagger and Jagalene had fallen to 5% and 0%, respectively. Acreage of the disease and Hessian fly resistant cultivar Duster increased from 0.3% of acreage in 2007 to 19.7% in 2013 and improved cultivars now occupy 47% of Oklahoma wheat acres. Unfortunately, the disease resistance of Jagger-derived lines such as OK Bullet and Fuller are no longer highly effective at preventing foliar disease and future efforts will focus on displacing these varieties with superior genetics of newer lines such as Gallagher and Iba. Gallagher, for example, fits a similar production profile as Duster but offers increased yield potential, foliar disease resistance, and kernel size without sacrificing Hessian fly resistance, acid soil tolerance, or fall forage production for dual-purpose systems. In 2012 Gallagher offered a 5.9 bu/ac average yield advantage over Duster, indicating a potential increase in Oklahoma farm revenue of $53 million annually if we meet our target of replacing 1.2 million acres of Duster with Gallagher in the next five to seven years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #3

1. Outcome Measures

Number of on-farm demonstrations of nitrogen rich strips and of hand-held sensors

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Current global nitrogen use efficiency for cereals production is estimated to be 33%. Environmental concerns and increasing fertilizer prices have necessitated improved precision in determining crop nitrogen requirements.

What has been done
Oklahoma State University has developed hand-held sensors and corresponding web-based decision aids that can be used to generate in-season nitrogen recommendations based on yield potential. This method is much more accurate than yield-goal-based systems in predicting high or low-yielding years where nitrogen fertilizer application rates should be adjusted accordingly. Sensor based nitrogen management presentations and demonstrations were given at 20 in-state grower meetings with approximately 1,000 individuals in attendance in 2014. The topic was presented in four out of state talks to a total audience of approximately 400 individuals. Two websites devoted nutrient management (nue.okstate.edu and npk.okstate.edu) were viewed approximately 20,000 times in 2014.

Results
In the fall of 2014 it is estimated that the N-Rich Strip and SBNRC was established on nearly 500,000 acres of Winter Wheat and Winter Canola. Recent research concluded that this technologies increases profit in winter crops by $10/ac resulting in a state wide impact of approximately $5 million. Additional to the success of the N-Rich strips is the commercialization of the smaller Hand Held GreenSeeker sensor. This sensor is sold at 10% of the cost ($50 versus $500) of the larger unit historically used. The adoption of this low cost sensor will greatly impact the state of Oklahoma as the implementation of the N-Rich Strip and Sensor Based Nitrogen Calculator which will ultimately the increase economic and environmental sustainability of winter wheat production in Oklahoma.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

Outcome #4

1. Outcome Measures

Locally-controlled evaluations and agronomic data for small grains crops

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	65

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Choosing the right cultivar is essential to ensuring economic profitability of any production system. Wheat yield data collected in 2010, for example, show that cultivar choice can easily increase gross income by more than $120 per acre and dramatically reduce pesticide use.

What has been done
The Oklahoma State University small grains variety testing program tests 25 to 45 released wheat cultivars and advanced experimental lines in replicated test plots at 25 to 30 sites throughout Oklahoma on an annual basis. The wheat multi-use team sows 40 to 45 additional non-replicated wheat variety demonstration tests at sites throughout Oklahoma. All but five of these sites are located on-farm and are conducted with the assistance of farmer-cooperators.

Results
Field day attendees typically represent over 1.7 million acres of wheat and report an average perceived value of the information received at field day events to be $21.46 per acre for a total impact of over $37 million annually.

Wheat phenological data, forage yield, grain yield, test weight, and protein content data were collected and posted near real time on the Oklahoma small grains variety testing site at www.wheat.okstate.edu. This site received an estimated 30,000 page views in 2014 and was reinforced with the @OSU_smallgrains Twitter feed which currently has over 950 followers. Hard copies of results were distributed to over 8,000 stakeholders in the state of Oklahoma via direct mailing and to over 700 producers via electronic copy. In-season recommendations and progress reports were provided by the World of Wheat blog at www.osuwheat.com. The blog received over 19,000 page views in 2014 and visitors represented 108 countries with most visitors originating from the US, France, and Canada.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #5

1. Outcome Measures

Improving Resistant Weed Management in Wheat

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Herbicide resistant weeds cost U.S. farmers $2 billion annually and 60 million acres are infested. Weed control represents a significant expense for farmers, but increased yields associated with controlling weeds generally far exceed the herbicide cost. When farmers rely too heavily on one herbicide chemistry or mode of action there is potential to select for herbicide-resistant weed populations. If farmers are aware of herbicide-resistant weeds in their fields, they can rotate crops, herbicide mode of action, or implement hand weeding to control the problem before it grows too large. If farmers are unaware of the presence of herbicide-resistant weeds, the return on their herbicide investment and grain yields will be greatly reduced.

Oklahoma farmers sow 5.3 million acres of wheat annually, and grassy weeds, such as Italian ryegrass, significantly limit wheat grain yield and marketability. Acetolactate synthase inhibiting herbicides (ALS) are the most popular herbicides for Oklahoma wheat farmers, but it is estimated that at least 50% of Italian ryegrass in Oklahoma wheat fields is ALS resistant.

What has been done
In 2014 the Oklahoma State University Weed Science Extension Program provided a free herbicide resistance diagnostic service to producers. Samples from 15 weed populations in Oklahoma were submitted for analysis, and samples represented some of the most difficult-to-control weeds in Oklahoma agriculture such as cheat, Italian ryegrass, marestail, Palmer amaranth, waterhemp and kochia. The most common resistant weed species in Oklahoma was ALS-resistant Italian ryegrass and approximately 50% of Italian ryegrass populations sampled in OK were found to be ALS-resistant.

Results

Herbicide cost to control non-resistant Italian ryegrass is approximately $8.25 per acre; however, this cost jumps to $28.80 per acre if the Italian-ryegrass is ALS resistant. So, prevention of herbicide resistance would save a 2,500 acre wheat farmer approximately $50,000 in herbicide costs annually. Research has shown that Italian ryegrass reduces wheat yield by 12 bushels per acre, and knowing the best weed control strategy to implement for control of Italian ryegrass would allow a 2,500 acre farmer to eliminate these losses adding another $220,000 to their bottom line.

The goal of this program is to help producers identify herbicide-resistant populations the first year they are experienced and offer alternative management solutions. As little as 20 minutes of hand weeding or spot application of a nonselective herbicide can prevent a small resistant population from growing out of control in a farm, state, or region. It is estimated that at least 900,000 acres of wheat are impacted by Italian ryegrass in Oklahoma. Modest progress in combatting herbicide-resistant Italian ryegrass could easily generate an additional $20 million in Oklahoma farm revenue.

Notes: Assumes $7.35 per bushel for HRW June 2014. NASS 2014 crop year data - 2.33 million acres planted and 1.54 million harvested. Most in this region that is not harvested is overseeded with ryegrass. Many farmers stopped cutting grain because they gave up the fight against Italian ryegrass. Assume that 0.5 of non-harvested acres could be cut for grain = 0.4 million. Assume 33% of acres harvested in the region have some level of Italian ryegrass = 0.5 million. So, a conservative estimate is about 900,000 acres affected.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
213	Weeds Affecting Plants

Outcome #6

1. Outcome Measures

New Herbicide Program Approach for Rescuegrass Weed Control in Wheat Production Systems in Oklahoma

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Currently, no conventional post-emergence herbicide treatment approaches are capable of controlling rescuegrass (Bromus catharticus) with only a few herbicides showing suppressive impact at low to moderate levels.

What has been done
Ongoing research and extension efforts are documenting the effectiveness and impact of pre-plant or pre-emerge herbicide application in wheat production systems for rescuegrass control. Rescuegrass, a bromegrass, is a particularly difficult weed to control in wheat production systems.

Results
Two current herbicides evaluated in the past few years, used alone or in tank mix combinations, have suppressive efficacy ratings of 70-90% utilizing a pre-plant or pre-emergence application method. They are OlympusTM and PrePare®. Research findings have been presented in numerous grower meetings and crop conferences along with extension field tours documenting and demonstrating these products and the application approach. According to industry representatives one of these products, PrePare®, has been sold for 90,000 acres in Southwest Oklahoma. This agrees with verbal and visual observations of extension professionals working with these products. Approximately 800 producers have been reached through 2 multi-state crops conferences, several local and area crops meetings, and 4 extension field tours where this application approach was demonstrated. Evaluations conducted at two crops conferences, where data from these field trials were part of the program, indicated that 43% and 32% of producers expected to make at least minimal changes in their production systems related to information presented at the meetings. The evaluation further showed that the average dollar value of impact for individuals attending these meetings was approximately $5500 each. These studies continue to be met with positive reception among producers with continued requests and interest in the results and findings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
213	Weeds Affecting Plants

Outcome #7

1. Outcome Measures

Economics of foliar fungicides for hard red winter wheat in the southern Great Plains

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Foliar diseases such as leaf rust (Puccinia triticina Erikss.), stripe rust (Puccinia striiformis Westend. f. sp. tritici Erikss.), and powdery mildew [Blumeria graminis (DC.) Speer f. sp. tritici emend. É.J. Marchal] often reduce the grain yield of winter wheat in the southern Great Plains. Yield losses from leaf rust alone have averaged over 3% per year from 1980 to 2011 in Oklahoma, with some individual year losses in excess of 10% (USDA ARS, 2012). Historically, control of these diseases through foliar fungicide applications has not been economical for U.S. producers. As a result, management of foliar diseases has largely relied on genetic resistance and other cultural practices such as crop rotations. However, in recent years there has been a growing interest in reevaluating fungicide treatments as part of an economically optimal foliar disease management plan.

What has been done
Primary data were produced in on-farm variety field trials managed by, agronomist Jeffrey T. Edwards and plant pathologist Robert M. Hunger.

Field days enabled direct observation of findings by farmers and ag business professionals. Findings were also made available on the web and via blog postings.

Findings were made available to the scientific community via a refereed journal article: Thompson, Nathanael M., Francis M. Epplin, Jeffrey T. Edwards, and Robert M. Hunger. Economics of foliar fungicides for hard red winter wheat in the Southern Great Plains. Crop Protection 59(2014):1-6.

Results

When averaged across years, plots to which fungicide was applied generated greater average net returns than plots that did not receive fungicide for susceptible varieties at one location, and for all varieties at another location. However, foliar fungicide application was not economical in every year at either location suggesting fungicide use should be reassessed each year given that profitability depends on year specific yield potential, prices, and foliar disease conditions. At both locations high disease incidence occurred in all but one site-year when the average March through May relative humidity exceeded 65%.

Additional research would be required to test the relationship between relative humidity and other environmental factors and disease incidence. The ultimate goal would be to develop an economic threshold decision aid that could be used to provide a timely recommendation to farmers based on conditions for specific locations for the specific growing season enabling growers to apply fungicide in regions and years with a high probability of economic benefit and avoid treatment in regions and years with a low probability of economic benefit.

Results of this analysis suggest that fungicide treatment on hard red winter wheat in the southern Great Plains can be an economically sound management strategy under some conditions. Despite the variable response, fungicide treatment did tend to protect producers from the downside risk of large yield losses in years of high disease incidence and severity, especially when growing wheat varieties susceptible to common foliar diseases.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
212	Diseases and Nematodes Affecting Plants

Outcome #8

1. Outcome Measures

No-Till Oklahoma Conference

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
No-till crop production systems are an accepted practice to minimize soil erosion. While no-till acreage in Oklahoma is no doubt increasing the state lags the national trend by about 10 years. Two primary items have slowed no-till adoption in Oklahoma. The first is grazing of winter wheat, either in graze out or dual purpose production systems and the second is the adoption of rotational crops.

What has been done
OSU Specialists have worked to establish Oklahoma State University as a leader in the tillage/cropping systems area. A conference has been conducted annually since 2008. The planning committee consists of producers, educators, government agency personnel, and industry representatives. Conference topics focus on issues related to reducing tillage operations in crop production systems specific to the Southern Great Plains. The 2-day conference is typically attended by more than 200 producers, educators, advisors, and policy makers.

Results
Producers were surveyed at the 2014 conference regarding their farm size, percent of farm in no-till, and their perceived value of the conference. There were almost 150,000 no-till acres represented at the conference and the average value of the information was $13.25 per acre. While there was certainly variation in responses, the total value of the conference based on the attendees' perception was estimated to be between $1million and $2 million. Given that no-till reduces erosion on average by 2.25 tons per acre per year this represents an annual reduction in erosion of approximately 335 thousand tons per year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

<u>Outcome #9</u>

1. Outcome Measures

Fertilization and economic feasibility of sweet sorghum grown as biofuel feedstock using commercial fertilizer

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A reticular set of environmental, agricultural, and energy issues may be alleviated through beneficial re-use of poultry litter as a nutrient source to poor quality soils for production of sweet sorghum as biofuel feedstock.

What has been done
This study assessed the viability of an integrated biofuel system that seeks to increase profitability of producing a biofuel crop using an organic by-product as an alternative to commercial fertilizer (CF). Sweet sorghum was established annually for three years on a relatively poor quality soil. Poultry litter was annually applied at four different application rates and CF applied at equivalent nitrogen (N), phosphorus (P), and potassium (K). Yield and changes in soil properties were monitored. Yield and input costs were used to determine economic return and viable litter transportation distances. Our results are in the process of being extended to producers and stakeholder sin the biofuel industry.

Results
OSU research field experiment results (published in Agronomy Journal) found that after three years of litter application, several soil quality parameters increased for litter amended soils compared to CF. Overall yields increased with nutrient application rate and yields from litter were not significantly different from CF, although economic return was greater for litter. While increased nutrient application rate increased overall economic return, this was a function of the year (i.e. climate). As a result of increased economic return from litter compared to CF, litter could be transported various distances depending on application rate. Break-even transport distance decreased with increased application rates. Use of litter as a nutrient source for growing sweet sorghum as biofuel feedstock can potentially improve water quality in source watersheds, improve soil quality, and reduce dependence on fossil fuels in an economically sustainable manner.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

Outcome #10

1. Outcome Measures

Drought monitoring: a system for tracking plant available soil moisture based on the Oklahoma Mesonet

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Real-time drought monitoring is essential for early detection and adaptive management to mitigate the negative impacts of drought on the people, economy, and ecosystems of Oklahoma, and improved drought monitoring is a key need identified in the 1995 Update of the Oklahoma Comprehensive Water Plan. Drought impacts can be severe in Oklahoma. For example, the 2006 drought cost the state's economy over $500 million from lost crop production alone. While drought monitoring is critical to Oklahoma's resource managers, it is hampered by a lack of data on a crucial drought indicator: plant available water. Crop yield losses and, by extension, the economic impacts of drought, are strongly linked to plant available water. Plant available water (PAW) is the amount of soil moisture currently in the profile which is available for plant uptake. Some water is held so strongly by the soil that it is not available to plants. The goal of this project was to improve drought monitoring in Oklahoma through the development of a Mesonet-based system for tracking plant available water.

What has been done
The project team collected and analyzed intact soil samples from each Mesonet site to determine the soil properties controlling the plant availability of soil moisture. The measured soil properties and the daily Mesonet soil moisture sensor data were combined to create operational daily PAW maps on the Mesonet website. This project resulted in educational opportunities and career training for five undergraduate students and one graduate student. The project has also directly contributed to the publication of two peer-reviewed journal articles, multiple scientific presentations and press releases, and two new funded research projects worth over $300,000, which build upon the PAW monitoring system.

Results

No other state in the nation and no other region in the world has a drought monitoring system like the one developed in this project. The new Mesonet PAW system provides resource managers with reliable, daily information on the remaining reserves of PAW. This system enables end users to more effectively adapt their management strategies. For example, by knowing early that PAW is decreasing and reaching critical minimum values, ranchers, facing the potential for reduced pasture, can make early arrangements to purchase hay or could sell cattle early, when prices are more favorable. Further, government agencies, such as the Oklahoma Water Resources Board, can gain a clearer picture of the extent of drought effects in the state and could target relief efforts more effectively. The new daily PAW maps are embedded in the ?Soil Moisture? section of the Mesonet website (www.mesonet.org), which reaches thousands of citizens every month. Since the PAW system was added, extension personnel indicate an increased interest in soil moisture information and both small and large agricultural producers have stated that they now monitor the PAW conditions on a regular basis using the Mesonet.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

Outcome #11

1. Outcome Measures

Canola Integrated Pest Management

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Canola is a potentially valuable rotation crop for Oklahoma wheat growers. It allows them opportunities to manage difficult grassy weeds such as Italian ryegrass, and cheat while providing them with an additional cash crop. Harvested acreage in Oklahoma has grown from 41acres in 2002 to over 150,000 acres in 2011-2012 worth ca. $55.1 million. However, insect pests (aphids

and caterpillars) regularly infest winter canola throughout winter and spring causing economic damage. In 2007, canola producers were surveyed about their pest management concerns and listed insects as the second most important production problem that they faced and aphids (cabbage, turnip and green peach aphids) the key insect pest problem. Because producers were unfamiliar with their management, they often made multiple insecticide applications to control them with limited success.
In addition, blackleg, a disease caused by Leptospaeria maculans had become a concern among growers.

What has been done
Entomologists and area agronomists conducted research demonstrations from 2005-2007 to evaluate management strategies for canola aphids. They determined that aphids could be effectively managed with a combination of insecticide seed treatments and regular scouting using a threshold of 200 aphids per plant. OSU Plant pathologists are currently screening germplasm for resistance to blackleg. They have identified five races for use in screening germplasm for resistance to blackleg disease.

Results
The research demonstrations showed that producers could save an average of $30 per acre by reducing insecticide applications from four per season to one with no loss in yield. This resulted in $3.7 million in potential cost savings in the 2013-14 canola crop.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations

Brief Explanation

Drought conditions continue to make research and trials difficult.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Wheat seed producers and merchandizers regularly provide sales data to help verify acreages planted to various varieties. - see State Defined Outcomes
Post demonstration trials field days' evaluations are completed by participants to estimate

value of information. - See State Defined Outcomes
Field trials are regularly used to test research findings. - see State Defined Outcomes

Key Items of Evaluation