2011 Oklahoma State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The Division of Agricultural Sciences and Natural Resources (DASNR) at Oklahoma State University has an integrated approach to research and extension programs. Over the past years the Oklahoma Agricultural Experiment Station (OAES) and the Oklahoma Cooperative Extension Service (OCES) have developed multidisciplinary TEAMS of research and extension faculty members working on priority research and extension program needs. The TEAMS are based on priorities identified by stakeholders and faculty and specialists. Our Planned Program areas as identified in our Plan of Work serve as overarching guides for the priority areas of research and extension. Each of the TEAM activities is thus covered under one of the Planned Program areas. Each of the faculty members and specialists remains administratively connected to a disciplinary department or geographic region unit. However, each also plans and conducts research and/or extension program efforts in close collaboration with other individuals within at least one multidisciplinary TEAM. Some significant research and/or extension efforts and developments during 2011 are presented following under the NIFA goal to which they most contribute:

Global Food Security and Hunger.

Hay ranks as the second largest crop grown and harvested in Oklahoma. Tremendous effort and expense goes into growing, cutting, baling, storing, transporting, and feeding hay in cow/calf enterprises across the state. In fact, recent data surveying 729 Oklahoma producers (Vestal et al., 2007) indicates that only 10% of cow/calf operations have a hay feeding season of 60 days or less. Most rely on harvested forages as the primary source of dietary nutrients for the majority of the winter (90 to 150 days). The group designed an experiment to determine the effects of a range of hay feeder designs on hay feeding waste. We discovered an incredible range of waste due to feeder type, with the lowest cost, economy feeder (most popular feeder style in OK) wasting 21% of the hay fed, and a higher cost modified cone feeder generating only 6% waste. Assuming a 5 year life of service for both feeder types, we calculate that the modified cone feeder type would generate a savings of approximately $1,000 over the economy feeder. This data was shared in local, regional and national publications, television programs, web sites and in over 50 educational presentations. One hay ring manufacturer observed a 52% increase in sales of modified cone style feeders in 2011 compared to the previous three year average. With extreme cost of hay in 2011 due to the drought, the economic impact to the state is estimated to be $2.8 million dollars per year (compared to only $1.5 million in 2010). This assumes only 5% of producers adopted a better feeder design to reduce hay waste. These results are applicable to cattle production throughout the region and nation where cattle are fed hay and will serve to reduce inputs and costs of raising animal protein used to feed the nation and globally through exports of beef.

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 2010-2011 canola crop.

Research using flatbed scanners to characterize properties in flour, soybeans, and milo has shown promise in elementary reflectance based sensing. Extensive research involving hundreds of samples with

varying amounts of foreign material and levels of rancidity have been collected and analyzed by the SPREC team and my research program. Correlations using hyperspectral and electromagnetic sensing have been established and publication of the research is in process. Initial results indicate the new system and procedures will detect factors that lead to rancidity, will be able to detect foreign material in crops objectively, and will estimate free fatty acids. This method of estimating the grade of specialty crops has the potential of making the difference between a producer selling his crop at the elevator and taking it back home to search for another use for a crop that is not US#1 grade. The estimate of the amount of foreign material may help producers save the unnecessary cost of cleaning the crop before marketing it. Quick, real-time assessment of essential constituents that determine oil and seed quality will help to insure top quality seed is receiving premium pricing and that the crop will store well. With an estimate of 1600 lbs/acre production in the case of such crops as canola, this advantage could total $15/acre. In recent years, more than 50,000 acres were planted to canola alone. This would provide almost another $1M of income to producers.

A particulate matter abatement device evaluation system has been designed, developed, and constructed and has been used to evaluate baffle type pre-separators, series cyclones, and the scalability of cyclones. This research can be utilized by industry and regulatory agencies to predict the effectiveness of a given abatement technology or technologies to reduce particulate matter emissions from a source with defined characteristics. The device can be used in prescription technologies for multi-point facilities. Example of recent industry application: a feed supplement company was given a notice of violation for excessive emissions. This company was facing closure due to the quantity of particulate matter being emitted from the facility. In addition, the company had a market for the material been emitted so it was missing out on potential sales. The company invested about $80,000 and installed new cyclones based on the criteria from this research and prior to the existing abatement devices. This system enhancement improved the facilities abatement system efficiency by 98%, increased average annual revenues by $470,423, and kept the plant from closure.

The OSU Soil, Water, and Forage Analytical Laboratory analyzed over 25,000 soil samples for farmers, representing approximately 2 million acres of agricultural land. An average 30 lbs per acre of nitrate-N was left in the soil profile due to the 2011 drought. Average savings in nitrogen fertilizer costs would be approximately $18 per acre for farmers who took credit for this residual nitrogen. Statewide impact of this nitrogen savings would total approximately $3.6 million in monetary savings in addition to extensive non-monetary environmental benefits from reduced nitrogen fertilization.

The Oklahoma State University small grains variety testing program tests 25 to 30 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 three of these sites are located on-farm and are conducted with the assistance of farmer-cooperators. 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 $37,000,000 annually.

Climate Change

There is significant concurance among meteorologists that climate warming and changes in seasonal temperatures are increasingly warming in North America. This will and is affecting crop production practices. Research and education programs are dealing with adjustment of earliest insurable planting

date for grain sorghum in Oklahoma. Early planting of grain sorghum can partially ameliorate the effects of heat and drought commonly experienced during the Oklahoma summer. The earliest insurable planting date for grain sorghum in Oklahoma, however, was established by the Risk Management Agency (RMA) as May 1. This planting date frequently pushed grain sorghum development well into Oklahoma's typical dry and hot summer. Beginning in 1999 the OSU Crop Management Team began experimenting with grain sorghum planting dates in north central and southwestern Oklahoma. Results from these experiments revealed that a late-April planting date offered a 30 to 50% yield advantage over a mid May planting date; therefore, two optimal grain sorghum planting windows in Oklahoma: April 15 to May 1 and June 1 to July 4. From 2003 to 2010 grain sorghum variety trials were sown around the state between April 16 and 29 with no losses dues to freeze. These data were presented to RMA along with a request to move the early planting date to April 15th.

Our work convinced RMA to move the early planting date to April 20 starting in the 2012 production season. Oklahoma grain sorghum producers typically budget for a 90 bu/ac yield if planted in April and our data show a yield loss of 27 to 45 bu/ac can be expected if planted in May. This equates to an increase of 148.50 to $247.50/ac of gross income for producers when sorghum in planted in late April as now allowed by the RMA. Oklahoma sorghum producers export their crop throughout the region, nationa and globally, therefore increases in productivity without increases in cost act to reduce the cost of food and increase food security globally.

Food Safety

A biological attack on United States crops, rangelands or forests could have severe impacts. Biocrimes, perpetrated for economic gain, are even more likely. Preparedness requires astrong national security plan that encompasses microbial forensics and criminal attribution. However, U.S. crop producers, consultants and agricultural scientists, unaccustomed to the possibility of intentional pathogen introduction, traditionally focus disease management strategies on prevention, rapid eradication or long-term management. New information, technologies and resources in microbial forensics (human, livestock and plant) are needed to enhance the nation's preparedness and responsiveness to plant health emergencies. As a National Bioforensic Analysis Center (NBFAC) Spoke Laboratory, the NIMFFAB developed highly validated real time PCR protocols for three plant pathogen models. We optimized assay conditions for each pathogen, validated them against panels of taxonomic and geographical near neighbors, and created artificial positive controls for each assay. Validated protocols were delivered to NBFAC and peer reviewed publications are in preparation. Results delivered to the NBFAC will be used as needed if needed and serve to increase food safety and security nationally and globally.

There are numerous antimicrobials identified annually for potential use against particular foodborne pathogens. The MIC of acetic acid, AFTECTm, AvGard XPTm, citric acid, CytoguardTm, lactic acid, lauric arginate, peroxyacetic acid, Purac XTendTm, and Syntrx 3300Tm was evaluated against mixed-strain cocktails of the 3 types of pathogens. The data identifies the levels of antimicrobial that gives slight and complete inhibition of the various pathogen cocktail mixtures. Our research suggests that, the antimicrobial efficacy at a lower use concentration and consequently offers a cost saving for the food industry.

Childhood Obesity

The OCES Healthy Oklahoma Impact Team (HOIT) educates Oklahoma youth on healthy food, nutrition and physical activity behaviors with the aim of reducing overweight and risk for related chronic disease. Efforts are conducted primarily in elementary classroom settings across the state using a six lesson series. Topics include increasing consumption of breakfast, using nutrition facts labels to make healthy snack choices, making healthy choices when eating out, making healthy beverage choices, increasing intake of dairy foods, fruits and vegetables, and increasing time participating in physical activity. Lessons are aligned with the Oklahoma Priority Academic Student Skills (PASS). Since

September 2008, the Farm to You exhibit was experienced by approximately 56,944 youth and 2,230 community volunteers in 56 counties. The average number of students reached per site visit over the 3 year period was 312 students and 12 community volunteers. In a case/controlled evaluation, the exhibit was found to enhance behavior change in students who were exposed to both classroom nutrition education lessons and the exhibit compared to those exposed solely to the classroom lessons. The project received national attention by being featured in Weighing the Options: How Can We Encourage Healthy Weights among America's Youth, a publication of the National Issues Forum Network, West Virginia Center for Civic Life. In 2010, it received the Dr. Rodney Huey Memorial Champion of Oklahoma Health Award.

The HOIT reached a total of 16,599 youth through school classroom nutrition education efforts. Important improvements in food, nutrition and physical activity behaviors were observed among participating Oklahoman youth which can have a role in reducing overweight and risk of related chronic diseases. The statistically significant observed improvements include:

- 33% increase in eating whole grain breads and cereals.
- 27% increase in eating fruits and vegetables.
- 27% increase in drinking milk or eating cheese or yogurt
- 32% increase in eating low-fat meats
- 33% increase in eating foods from 2 or 3 MyPyramid food groups for breakfast.
- 29% increase in snacking only when hungry.
- 39% increase in using nutrition facts labels to make food and beverage choices.
- 34% increase in eating small amounts of high fat foods.
- 34% increase in eating small amounts of sugar-sweetened beverages.
- 23% increase in time spent in physical activity.

CNEP educates Oklahoma youth on healthy food choices, safe food practices and physical activity with the purpose of reducing overweight and obesity and the associated risk of related chronic disease. CNEP staff provided a total of 5,598 hours of nutrition information on healthy eating practices, food preparation and food safety to 23,332 qualifying Oklahoma youth during the 2011 fiscal year. The majority of enrolled youth (19,556) were taught through school enrichment programs; while 3,776 children received their nutrition education through short term community based programs. After participating in CNEP, approximately 12% of surveyed youth participants more often consumed low-cost, healthy foods and 9% increased their frequency of hand washing. Based on a 2009 study, estimated potential health care savings associated with nutrition education programs similar to the CNEP were approximately $26 million due to increased prevention of nutrition-related chronic diseases and conditions.

Sustainable Energy

Results of the field research conducted to date and the economic analysis of results indicates that Oklahoma has a comparative advantage in switchgrass production. The USEPA (2010) estimated that 85% of the biofuel produced from switchgrass in the U.S. if the 2007 EISA mandates are maintained through 2022, would be from biorefineries located in Oklahoma. Based on our research findings, Oklahoma is expected to have a comparative advantage in switchgrass for biorefinery feedstock production because of relatively inexpensive land, a longer growing season, expected high production density per acre, and a substantially wider harvest window . The farm gate cost to produce a dry ton of switchgrass in Oklahoma is expected to be slightly lower than the farm gate cost to produce crop residues from corn stover in the U.S. Corn Belt. Based on these results and projected needs for fuel, the State of Oklahoma may use this information to encourage construction of biorefineries as follows. Seven cellulosic

ethanol biorefineries that process switchgrass feedstock are expected to be located in Oklahoma by 2022 with total annual capacity of almost 800 million gallons. This USEPA estimate is consistent with the projection of six cellulosic ethanol plants in a base Oklahoma model. It is estimated that 100 % of the dedicated energy crop feedstock required by the Oklahoma biorefineries will be produced in Oklahoma . Based on economic models used to estimate the consequences of the EISA 2022 goals, the expected increase in biofuels production would result in a significant increase in net farm income to the U.S. agricultural and livestock sector. If the conversion goals are met, annual net U.S. farm income is expected to increase by $7.1 billion dollars (10.6%) in 2022 relative to what it would be in the absence of the EISA legislation.

Other

Plant Biological Technologies. Results of research on virus and plant-virus interactions led to significant advances in knowledge including the following:

- Important hypotheses received observational support, putting them on the road to becoming general knowledge. These include: known plant-associated virus species represent but a small fraction of extant plant viruses; viruses of wild plants contain unusual genes and genome features; some viral lineages have codiverged with the lineages of their hosts, suggesting that viruses play essential roles in ecosystems; viruses are not necessarily pathogenic

- Multiple laboratories have taken our lead in exploration of the uncharted virus world.

- Plant diagnosticians around the world are considering microarrays and database e-probes as means to solve challenging diagnostic problems.

- Microarray hybridization for virus detection is being used commercially and is being contemplated for use by regulatory government laboratories.

- Our finding of over 300 previously not described viruses solely by sequence identification has caused virologists to reevaluate the standards for virus designation and naming

A musk thistle IPM program was developed in the early 1990s and has been implemented statewide through cooperative efforts of researchers, Extension personnel, and landowners. It focuses on increasing public awareness of the problem, development of educational information, demonstrating various control options, and introducing new biological control agents. To date, this program collected and redistributed more than 880,000 musk thistle head weevils and 42,910 musk thistle rosette weevils across the state. Landowners in NE Oklahoma have noted from 80% to 95 % decrease in number of musk thistle plants in areas where they are using an integrated approach that includes use of the musk thistle weevils. If the typical landowner applies 1 lb active ingredient of herbicides per acre annually, biological control has decreased the amount of herbicides applied to the environment by 7.1 million lbs per year.

In 2011, the Applications Engineers client projects resulted in increased sales of more than $18.4M, while retaining an additional $15.0M in sales that would have otherwise been lost. Further, the expertise provided by our engineers created cost savings of $4.4M, and avoided additional costs estimated at $3.1M. With 110 new jobs created and 68 jobs retained, our projects provided an additional $13.4M to the state's economy. Finally, we invested over $10.8M in new plant facilities and equipment, for a total economic impact of $65.3M.

Oklahoma Military Kids (OMK) youth program created two 4-H National Guard Clubs through a close partnership and network with the Oklahoma National Guard. Five Camping opportunities were provided to military kids and their family to help cope with the stresses of deployment and reintegration upon returning. A Speak Out Military Kids camp was conducted to empower military teens to express their stories and raise awareness of the issues facing military kids. Nineteen RSG trainings and seven informational briefings were conducted to educate the Oklahoma communities and develop vigilance and understanding to develop support during the deployment cycle. A fund raising initiative with Frontier City and White Water Bay resulted in $350 to the 4-H Foundation to be used for military kid support. Presentations were conducted to 4-H youth while preparing and fostering connection to military kids through the Hero Pack project. During 2011 the 4-H military partnership and the OMK initiative has reached 2,416 children and from the 4-H club grant allowed the opportunity to reach an aggregated total of 391 military children. Currently, there is a 4-H club on each activity duty installation to include McAlester Ammunition Depot, Fort Sill Army Post, Tinker Air Force Base, Vance Air Force Base, and Altus Air Force Base. Plus the first 4-H club to be installed on the Tulsa Oklahoma Air National Guard Base 138th Fighter Wing with 34 members and the first 4-H club to be established with the Oklahoma Army National Guard Youth Teen Panel with 12 members. A total of 1407 Hero Packs were assembled and distributed. All totaled youth focused programs were conducted reaching a total of 4,453 military related individuals. Other Agencies involved as local partners with OMK: American Legion, State Dept of Education, Boys and Girls Clubs, Army National Guard, Active Day Army Garrison Staff, Army Reserve, Navy Reserve, Air Force Reserve, Oklahoma National Guard.

The 1998 Oklahoma Registered Poultry Feeding Operations Act and the Poultry Waste Applicators Certification Act were established in response to concerns about phosphorus from poultry litter polluting important water resources. Specifically, the Eucha-Spavinaw and Illinois River watersheds have been the focus of regional and national attention in regards to litigation and regulation over water quality concerns. As set forth in the Acts, all poultry production operators and poultry waste applicators must complete an initial nine-hour series of Oklahoma Cooperative Extension Service (OCES) Poultry Waste Management (PWM) educational sessions followed by continuing education. In 2011, the OCES PWM Education Program continued to provide the required training, addressing water quality concerns associated with improper or excessive land application of poultry litter. Over 1,000 people participated in the program during 2011. A report of 2010 and 2011 poultry waste production and movement, prepared by the ODAFF, indicates some dramatic positive changes. Due in no small part to the PWM Education Program and the efforts of OCES Educators and Specialists, this is a tremendous example of the impact we have had.

Okla. Illinois River Watershed: 88% of poultry waste exported out in 2010
Eucha-Spavinaw Watershed: 90% of poultry waste exported out in 2011

Total Actual Amount of professional FTEs/SYs for this State

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	199.0	0.0	90.0	0.0
Actual	256.0	0.0	85.0	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- Combined External and Internal University Panel
- Expert Peer Review
- Other (Administrative Review)

2. Brief Explanation

All OAES/OCES teams are required to have a team plan of work which is reviewed by team members, the administrative leaders, and the appropriate OAES/OCES assistant and associate directors. All team plans of work are reviewed with respect to relevance, the Division Strategic Plan, stakeholder input, and team competitive advantage. All individual OCES plans of work (year and annual) developed by county, area, district and state program professionals are reviewed in reference to quality and relevance by at least two individuals with program and/or administrative responsibility pertinent to the individual's program area. The reviewers assess the merit of the program plans of work with respect to issues, needs, and problems identified through stakeholder input, quantity of effort planned in relation to appointment, and plans to evaluate and report program quality and impact. County plans are reviewed by the appropriate district subject matter specialist, district director, and state program leader (when appropriate). Area and district specialist plans are reviewed by the district director, the subject matter department head, and appropriate assistant director/state program leader. State specialist plans are reviewed by the appropriate department head and the appropriate assistant director/state program leader.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals

- Survey of the general public
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public
- Other (Professional journals, meetings, etc.)

Brief explanation.

A broad array of actions were used to encourage stakeholder input. Personal invitation and public notice are regularly used in Extension Program Advisory Committees as well as when we seek input to experiment station projects. Most all statewide and unit advisory groups are notified through direct contact. Several programs have targeted nontraditional stakeholder participation including sustainable agriculture, agribiosecurity, water, wildlife, youth, human health, Spanish speaking audiences, etc. Numerous Native American tribal leaders have been invited to state and district discussions. Farm commodity groups regularly are invited to campus and we attend most of their meetings in order to hear input. A few of our advisory groups are statutory in nature.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief explanation.

Every County CES office holds 2-4 program advisory meetings annually. OCES and OAES also meet with numerous boards, commissions, associations, public agencies, departmental advisory committees, special needs groups, individuals, businesses, etc each year. See state report each year to get a partial list of groups providing input. Family Consumer Science and 4-H Youth programs conducted listening sessions at numerous locations around the state in preparation of the development of this plan.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting specifically with non-traditional groups

- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Other (Peer reviews, grant proposal reviews)

Brief explanation.

Following are some examples of stakeholder input- this list is in no way exhaustive. Representatives from OAES and/or OCES met with the following stakeholder groups:

Division of Agricultural Sciences and Natural Resources Advisory Council (twice per year)

Oklahoma Wheat Commission (ten times per year)

Oklahoma Peanut Commission (twice per year)

Oklahoma Sorghum Commission (twice per year)

Oklahoma Wheat Growers Association Board (twice per year)

Oklahoma Crop Improvement Association Board (three times per year)

Soil Fertility Research and Education Advisory Board (three times per year)

Canola Advisory Board (twice per year)

Oklahoma Grain and Feed Association

Oklahoma Seed Trade Association

Oklahoma Genetics Inc. Board

Oklahoma Home and Community Education

Oklahoma Ag in the Classroom Advisory Committee (Quarterly)

4-H Shooting Sports Committee

Land Judging Committee

Health Rocks Advisory Team

4-H Centennial Gardens Committee (twice per year)

Ok Youth Forestry and Wildlife Camp Committee (six times)

Northeast Oklahoma Beekeepers Association

USGA Advisory Committee

Oklahoma Pecan Growers Association

Rural Health Works Committee

Rural Health Works National Advisory Committee

Stormwater Advisory Committee

Tribal On-Site Waste Project Advisory Committee

Oklahoma State Water Plan

Integrated Environmental Research and Education Site Advisory Committee

Oklahoma Sustainable Agriculture Research and Extension Advisory Committee

Oklahoma Food and Agricultural Advisory Center Advisory Committee (twice per year)

In all these settings we listen to the expressed problems, concerns, opportunities and situations faced by the various groups. This is in addition to the county PACs which were described earleir and result in over 1000 people providing input at the local level. Likewise we periodically conduct surveys with respect to particular issues or groups of people.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities
- Other (In team planning and budget requests)

Brief explanation.

Input was used in decisions as to filling vacant positions in a difficult budget time. These decisions resulted in filling a 4-H District position, a meat scientist, and a beef production specialist.

Much input was received on drought conditions. We changed much programming to include drought related programs, forage nitrate testing, cattle feeding, tax implication education, etc. Drought issues brought forward by PAC attendees included:

- Rebuilding cowherds will be expensive
- Pasture Renovation/weed control options following drought

- Discovery/utilization of more drought tolerant forage base
- Proper stocking rates for post-drought recovery of pastures
- Stocker programs for traditional cow-calf operations
- Increased feed/hay cost
- Methods to extend hay supply

The state water plan wqs just completed last year so because of that and the drought, there was much input on water quality, quanity, pond management, water rights.

Brief Explanation of what you learned from your Stakeholders

Drought issues were high on the producers' minds - these include issues such as use of CRP land, risk management for forage and hay producers, tax programs.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
5470234	0	4008447	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	4674608	0	4008447	0
Actual Matching	4674608	0	4008447	0
Actual All Other	28056371	0	22129419	0
Total Actual Expended	37405587	0	30146313	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	4674608	0	0	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger - Animal Enterprises

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
121	Management of Range Resources	17%		15%	
302	Nutrient Utilization in Animals	13%		20%	
303	Genetic Improvement of Animals	5%		10%	
304	Animal Genome	0%		10%	
305	Animal Physiological Processes	0%		10%	
306	Environmental Stress in Animals	20%		10%	
307	Animal Management Systems	30%		10%	
308	Improved Animal Products (Before Harvest)	5%		5%	
311	Animal Diseases	4%		5%	
315	Animal Welfare/Well-Being and Protection	6%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	22.0	0.0	5.0	0.0
Actual Paid Professional	23.0	0.0	8.0	0.0
Actual Volunteer	6.3	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**
415000	0	386930	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
415000	0	386930	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2801000	0	2136044	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct drought response specific educational meetings and demonstrations.

Develop research-based information and disseminate through peer reviewed journal articles, scientific reviews, and abstracts.

Develop decision aids and management programs that assist cattle and forage managers in making better informed decisions.

Conduct educational programs to improve the management skills, profitability and other success factors of people managing cattle and forages. Outputs for these activities will include fact sheets, books, and other extension publications, conference proceedings, web sites and conferences, and cattle enrolled in value-enhancement programs.

Identify BVDV infected beef breeding herds and develop a control program including biosecurity and enhanced vaccination programs.

Demonstrate the economic effects of BVDV and BRD on stocker and feedlot operations.

Develop support for BVDV control within breeding herds to provide increased economic return.

In animals exposed to BVDV, BRD, or both, we will identify biological links that exist between the bacteria and/or virus, reduced animal performance, and meat quality.

2. Brief description of the target audience

Managers, owners and employees of farms, ranches and agribusinesses, research scientists, extension personnel, beef cattle producers, shool aged children, and consumers.

3. How was eXtension used?

Active participation in the Horse CoP.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	125482	7000057	3000	2222000

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	11	26	37

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Conferences, symposiums, and meetings

Year	Actual
2011	145

Output #2

Output Measure

- Peered reviewed journal articles

Year	Actual
2011	26

Output #3

Output Measure

- Extension publications: fact sheets, proceedings, books, manuals, bulletins

Year	Actual
2011	217

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of producers registered with a premise ID
2	Total number of producers certified as Master Cattlemen
3	Number of producers implementing improved management, grazing systems and beef production systems resulting in improved sustainability.
4	Number of producers implementing management programs to decrease the incidence and economic impact of BVDV and BRD
5	Number of producers certified in the Beef Quality Assurance program
6	Number of cattle enrolled in value enhancement programs
7	Animal Enterprise Programming Related to 2011 Drought

Outcome #1

1. Outcome Measures

Number of producers registered with a premise ID

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Total number of producers certified as Master Cattlemen

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	655

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Beef production accounts for approximately one-third of Oklahoma's agricultural production in most years. Moreover, seventy percent of the state's 86,000 farms have some cattle and over fifty percent of the land area in Oklahoma is pasture or rangeland. Most of the cattle operations are small in size, with seventy-eight percent of the beef cow inventory in herds of fifty head or less. Smaller cattle operations have higher cost of production and are less likely to incorporate best management practices.

What has been done
The Master Cattleman Program is conducted by an interdisciplinary team resulting in a variety of educational products and programs, including the Beef Cattle Manual, benchmarking of cow/calf and stocker producer practices, Master Cattleman programs delivered at the local level and in-service training for Extension educators. An interdisciplinary Beef Cattle Manual was updated and published. The manual contains 41 chapters addressing various business, production, and natural resource topics. Approximately 312 manuals were distributed in 2011 and a total of about 9,000 have been distributed since program inception through local Extension offices, area and state meetings and from the Master Cattleman website. Requests have been filled to 25 states and 5 foreign countries. The manual is being used as a textbook in 8 universities and community colleges.

Results
To become a Master Cattleman, a producer completes twenty eight hours of instruction from the Beef Cattle Manual and associated quizzes. The program has enjoyed wide adoption in the state and it continues to be a popular staple in educational programming. Approximately 655 students have graduated with 71 having graduated during 2011. Currently, 119 students are enrolled from 22 Oklahoma Counties. Graduates average response to their estimate of annual improvement in their cattle operation's profitability is $3,500 for a total annual impact of $2.3 million. On average, graduates indicate that they use the Beef Cattle Manual at least once monthly and that they have referred 5 additional people to the Beef Cattle Manual and three people to the Master Cattleman program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
306	Environmental Stress in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #3

1. Outcome Measures

Number of producers implementing improved management, grazing systems and beef production systems resulting in improved sustainability.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2245

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Hay ranks as the second largest crop grown and harvested in Oklahoma. Tremendous effort and expense goes into growing, cutting, baling, storing, transporting, and feeding hay in cow/calf

enterprises across the state. In fact, recent data surveying 729 Oklahoma producers (Vestal et al., 2007) indicates that only 10% of cow/calf operations have a hay feeding season of 60 days or less. Most rely on harvested forages as the primary source of dietary nutrients for the majority of the winter (90 to 150 days).

What has been done
The group designed an experiment to determine the effects of a range of hay feeder designs on hay feeding waste. We discovered an incredible range of waste due to feeder type, with the lowest cost, economy feeder (most popular feeder style in OK) wasting 21% of the hay fed, and a higher cost modified cone feeder generating only 6% waste.

Results
Assuming a 5 year life of service for both feeder types, we calculate that the modified cone feeder type would generate a savings of approximately $1,000 over the economy feeder. This data was shared in local, regional and national publications, television programs, web sites and in over 50 educational presentations. One hay ring manufacturer observed a 52% increase in sales of modified cone style feeders in 2011 compared to the previous three year average. With extreme cost of hay in 2011 due to the drought, the economic impact to the state is estimated to be $2.8 million dollars per year (compared to only $1.5 million in 2010). This assumes only 5% of producers adopted a better feeder design to reduce hay waste.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
302	Nutrient Utilization in Animals
306	Environmental Stress in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

Outcome #4

1. Outcome Measures

Number of producers implementing management programs to decrease the incidence and economic impact of BVDV and BRD

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2011	175

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
311	Animal Diseases

Outcome #5

1. Outcome Measures

Number of producers certified in the Beef Quality Assurance program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	514

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cattle sickness costs the industry millions of dollars each year. These losses negatively impact producer profitability and they impact each and every level of the beef production chain.

What has been done
In order to facilitate the adoption of best management practices that should result in reduced sickness and associated adverse effects, the Oklahoma Quality Beef Network (OQBN) was initially developed in 2001 and redefined in 2009. The objective is to add value to Oklahoma?s calf crop and capture at least part of the added value.

Results

In 2011, 103 Oklahoma beef producers enrolled 4,493 calves in the OQBN program. Nine regional OQBN Vac-45 calf sales were conducted in seven livestock markets. OQBN cattle received a premium of $6.54/cwt, based on the weighted average price of all lots, over non-preconditioned cattle. The average price premium is an additional $39.24 per head, while the added value of weight gain during the preconditioning period averaged $71 per head for a gross increase in revenue of $110 per calf. Average cost to participate in the program was about $50 per head, resulting in a net increase in income of $60 per head or total net increase in income of $269,580 for the calves enrolled in the program in 2011. However, the educational program and example given by the OQBN is stimulating growth in adoption of these management, certification and marketing practices throughout the state. Therefore, the impact is much higher than can be measured by direct participation in the program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
315	Animal Welfare/Well-Being and Protection

Outcome #6

1. Outcome Measures

Number of cattle enrolled in value enhancement programs

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	4493

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results
Involvement in this program was drastically reduced in 2011 due to extreme drought.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
315	Animal Welfare/Well-Being and Protection

Outcome #7

1. Outcome Measures

Animal Enterprise Programming Related to 2011 Drought

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The 2011 drought in Oklahoma was the most significant in recent decades. By late summer, over 90 percent of the state was classified in the D3 (Extreme) category with 66 percent classified in the D4 (Exceptional) drought category. Rainfall as a percent of normal in the regional weather categories averaged between 31 and 56 percent which translates into 11 to 17 inches of rainfall less than normal. The impact of extremely high temperatures was also a significant factor which took a tremendous toll on livestock and forage production. In the western half of the state (except Cimarron County), all Mesonet stations had over 52 days of over 100º F temperatures with 14 stations registering over 70 days of 100º F or greater high temperatures. The number of commercial beef cows in Oklahoma was reduced by over 280,000 cows and the summertime sales volume at local and regional livestock auctions was many times greater than previous years. Hay for cattle feed became a premium commodity. The supply of hay became scarce early in the buying season and prices increased two and three fold. As summer crops failed in the drought, the residual forage became sought after as livestock feed. Potentially high levels of nitrates were often present in drought stressed forages and testing was required to insure its safety when feeding to beef cattle.

What has been done

OCES County Agriculture Educators, plus Area and State Extension Specialists were inundated throughout the summer and fall with requests for information regarding management issues and

alternatives related to the drought. Over 2,400 forage samples were submitted to the OSU Soils and Forage Testing Laboratory for analysis of nitrate content. Approximately one-third of the samples came from the Southwest district, one-third from the Northwest district and one-third from the eastern half of the state. Over 600 samples had elevated levels of nitrate requiring feeding instruction that involved restricting intake or utilizing the hay on only certain classifications of beef cattle. Results from 245 tests (10%) were over the safe feeding limit for cattle of any size or age. Cattle producers buying, swathing, baling, and feeding hay heavily utilized the nitrate quick test at the County Extension offices. Over 165 bottles of nitrate drop test solution were distributed to county offices across the state in 2011 compared to 74 in 2010. Over 8,000 field samples were quick tested by Extension Educators during the drought months. As Educators performed these numerous quick tests, countless hours of one-on-one consultation regarding cattle and pasture management specific to each individual producer?s situations and circumstances were accomplished. The Oklahoma Animal Disease Diagnostic Laboratory tested over 1xx water samples for blue-green algae and other water quality related issues. Educational information on dealing with blue-green algae infected ponds was addressed in many of the drought meetings and individually with each producer that submitted a positive test. Five regional and 32 county meetings were held across the state with over 2,245 producers in attendance. Drought meeting topics included pasture management, livestock water quality, hay feeding waste reduction, hay issues regarding nitrate, prussic acid and aflatoxin contamination, economics of selling cull cows, and tax consequences of drought related cattle sales.

Results

Forage testing for nitrates identified 600 samples, representing over 7,200 tons of hay, which could have potentially caused abortion death loss in beef cows. Through testing and OCES consultation, Oklahoma beef producers could realize an additional $1.1 million in gross income during 2012 due to diminishing abortion death losses during the 2011 drought. In addition, over 245 samples tested through the SWFAL were potentially toxic for nitrates. By utilizing alternative feeding strategies or removing these bales from use altogether, OCES alleviated a potential loss to beef producers of well over $ 500,000.

The drought of 2011 had a significant impact on Oklahoma beef producers. Herd liquidation due to the poor forage production year will reduce the overall productivity of commercial beef herds in the state for several years. An extra $200 million worth of beef cows were removed from the Oklahoma beef herd in 2011 than would normally have been culled. Discussion of the tax rules for drought sales was part of the educational programming conducted by OCES. Estimate tax savings of property applying the rules which avoids the bunching of income into a single tax year would be more than 25 million dollars.

Warm season annual grain crops were severely impacted by the drought conditions. By working with OCES educators, crop producers quick sampled and lab tested the residual forage to harvest a marketable forage product and therefore salvage needed farm income. Estimates of hay income from summer annual crop acres that were nitrate tested through the SWFAL exceed $14 million.

Five regional and 32 county OCES led meetings were held in response the drought reaching over 2,200 beef producers. Producers were given instruction on: 1) proper hay feeding amounts to meet a beef cows nutrition needs 2) hay bale feeder alternatives to reduce hay feeding waste 3) forage nitrate levels that can cause abortion or death in their cow herd 4) identifying blue-green algae in farm ponds to prevent death loss and 5) inclusion of monensin in feed supplements increases hay feeding efficiency in gestating cows.

4. Associated Knowledge Areas

KA Code	Knowledge Area

121	Management of Range Resources
302	Nutrient Utilization in Animals
306	Environmental Stress in Animals
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

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
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Extreme drought caused a reduction in many on-going programs. However, it increased educational efforts in cattle management in under drought and heat stress, tax management, culling options, alternative feeds, nitrate testing, stress on cows, etc.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

See outcomes 2 and 5 for impact data from participant evaluations.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Global Food Security and Hunger - Crop Enterprises

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	23%		5%	
133	Pollution Prevention and Mitigation	3%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	5%		20%	
204	Plant Product Quality and Utility (Preharvest)	10%		10%	
205	Plant Management Systems	36%		20%	
211	Insects, Mites, and Other Arthropods Affecting Plants	4%		10%	
212	Pathogens and Nematodes Affecting Plants	3%		10%	
213	Weeds Affecting Plants	6%		5%	
215	Biological Control of Pests Affecting Plants	2%		5%	
216	Integrated Pest Management Systems	8%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	18.0	0.0	6.0	0.0
Actual Paid Professional	18.0	0.0	11.0	0.0
Actual Volunteer	1.5	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**
340000	0	523129	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
340000	0	523129	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2300000	0	2887932	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Wheat variety development and testing
Develop a no-till production manual
Wheat quality and product development and testing
Wheat management newsletter, website
Develop a Canola production manual.
Test and demonstrate alternative cropping systems and rotations
Improve web-based delivery of cropping systems information
Weekly crop updates during production season
Grower meetings/workshops
Field/demonstration days

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 and other crop producers and nutraceutical producers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	40005	3073529	2500	100000

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

Patent Applications Submitted

Year: 2011
Actual: 2

Patents listed
PVP for wheat varieties

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	20	45	65

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Field Demonstrations

Year	Actual
2011	215

Output #2

Output Measure

- Varieties of wheat released

Year	Actual
2011	2

Output #3

Output Measure

- Crop production manuals and production newsletters

Year	Actual
2011	120

Output #4

Output Measure

- Cotton Web Page

Year	Actual

2011 1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Percentage of dual-purpose wheat acreage where first hollow stem criterion used for decision making

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wheat fields utilized for livestock grazing during the fall/winter and then harvested for grain by early summer are termed dual-purpose wheat fields. Proper timing of livestock grazing termination at the ¼ inch First Hollow Stem (FHS) stage of growth is critical in avoiding large grain yield losses caused by overgrazing wheat pastures. Because grazing termination dates can vary greatly on a field-by-field basis due to planting date and the particular variety planted, FHS is the single best way for stocker cattle producers to determine exact times for grazing termination. Oklahoma has about 5.7 million acres of wheat planted annually, of which, about 2.5 million acres are utilized by farmers as dual-purpose wheat acres.

What has been done
Research indicates overgrazing wheat pasture by just one week can result in a decreased grain yield of up to 25% at harvest and mistiming grazing termination by two weeks will reduce the bushels of wheat at harvest by up to 60%! Given average yield, this equates into a 19 bu/ac loss. At current prices, this amounts to a $150 + per acre potential loss of income for dual-purpose wheat producers or a $380,000,000 potential annual loss for the state of Oklahoma. To help prevent these losses, we monitor first hollow stem, conduct in-service trainings, and hold grower workshops on methodology and benefits of scouting for first hollow stem.

Results
It is estimated that at least 75% of dual-purpose wheat producers in Oklahoma use first hollow stem as a criterion for removal of cattle from wheat pasture. First hollow stem was monitored at two locations (Stillwater and El Reno, OK) and data were distributed to extension educators and stakeholders via electronic newsletter. It is estimated that at least 80% of dual-purpose wheat producers follow these numbers and use them as a rule of thumb estimator for removal of cattle from wheat pasture. Using this indicator helps producers reduce lost production at about $280

million annually from traditional methods.

Several producers have commented on the usefulness of this information. A prominent rancher in southern Oklahoma, for example, recently commented "I appreciate you guys distributing the first hollow stem data from the El Reno site. It matches what I have been finding in my field and lets me know that I am making the right decision."

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #2

1. Outcome Measures

Number of wheat varieties released to address agronomic and end-use quality needs of hard red winter wheat industry

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
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 25 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
The Oklahoma Agricultural Experiment station released the hard red winter wheat cultivars 'Ruby Lee' and 'Garrison' in 2011.

Ruby Lee is a very high-yield potential variety with genetic resistance to Hessian fly, a devastating insect pest, and tolerance to barley yellow dwarf virus that is transmitted by aphids. It is likely to find a strong following among producers utilizing intensive management techniques and those looking for an early-maturing variety to balance out the extensive offering of medium and late-maturing cultivars in the region.

Garrison has similar grazing tolerance and adaptability as 'Endurance', the most popular wheat variety in Oklahoma, but offers 5 to 10% greater grain yield. Garrison also offers superior genetic resistance to stripe rust, wheat spindle streak mosaic virus, and septoria leaf blotch, lessening the need for foliar fungicide use. When combined with superior low soil pH tolerance and improved test weight, it is likely that Garrison will be adopted by many dual-purpose and grain-only wheat producers in the southern Great Plains.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Locally-controlled evaluations and agronomic data for oilseed crops

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	32

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Genotype by environment interaction is the overriding factor determining yield and many end-use quality parameters. Therefore, stakeholders require locally-controlled, research-based quantitative comparisons of crop cultivars commonly grown in the southern Great Plains. Many of these oilseed crops have not been grown in Oklahoma and lack of production knowledge has been cited as a reason for not planting some of these crops. In addition stakeholders need the opportunity to evaluate new cultivars and advanced experimental lines in ?real world? settings.

What has been done
Replicated performance trials have been established across Oklahoma to evaluate peanut, winter canola, sunflower, sesame, and soybean cultivars. In addition to cultivar performance trials, trials have been initiated to develop basic agronomic recommendations for several oilseed crops. Scientists will use the information collected from all of these trials to develop agronomic recommendations. In turn, these recommendations will be used to educate producers on profitable crop production practices. Thirty locations around Oklahoma were utilized to evaluate cultivars for the major oilseeds produced in Oklahoma.

Results
Grain yield and other agronomic data for each variety of each crop were collected and distributed to stakeholders throughout the southern Great Plains. Over 1,500 stakeholders directly participated in field day activities at these research locations. Five extension publications were published and distributed to a minimum of 700 people via email list serve. Another 500 individuals received hard copies at meeting functions.

Performance test data is among the most frequently requested and most highly valued data requested by stakeholders each year. In addition to Performance trials, data was collected from research plots to develop basic agronomic recommendations (Nitrogen management, seeding rate, and planting date) for sunflower and sesame production in Oklahoma. This information is critical and helped to increase acreage for ?new? crops, such as, sesame and canola. Since 2004, winter canola acreage has increased dramatically on the southern plains when 25,000 acres were planted, compared to 2011 when planted acres topped 125,000. Similarly, sesame production in the southern Plains has increased from 6,000 ac in 2007 to nearly 120,000 ac reported in 2011.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #4

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
2011	44

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 2011 acreage of Jagger and Jagalene had fallen to 10% and 1%, respectively. Acreage of the disease and Hessian fly resistant cultivar "Duster" increased from 0.3% of acreage in 2007 to 16.4% in 2011 and improved cultivars now occupy 44% 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 Ruby Lee and Garrison. Acreage of the pest-resistant variety 'Duster', for example grew by 8% in 2011 and offered an average 5 bu/ac increase over

older, more disease-prone varieties. This was particularly impressive given the record-setting drought conditions of 2011. This shift in acreage generated approximately $15 million (8% x 5.4 million acres x 5 bu/ac x $7 bu) for the Oklahoma rural economy. This also means additional wheat could be made available to foreign markets as Oklahoma is a major provider of hard red winter wheat in international markets.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Increase in knowledge and adoption rate of reduced tillage practices and crop rotation - acres effected

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of crop acres where fertilization decisions include sensor-based fertilization information

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	500000

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 46 grower meetings with approximately 1,700 individuals in attendance in 2011. Two websites devoted nutrient management (nue.okstate.edu and npk.okstate.edu) were viewed approximately 20,000 times in 2011.

Results
In 2008 a survey of Extension educators indicated that sensor-based nitrogen management practices were used on approximately 240,000 acres of winter wheat. This estimate doubled to 500,000 acres of winter wheat and canola in the fall of 2011. According to a recent research study, use of the sensor-based system increases profit in winter crops by approximately $10/ac resulting in a statewide impact of approximately $5,000,000 annually.

4. Associated Knowledge Areas

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

Outcome #7

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
2011	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 30 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 three 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 $37,000,000 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 over 35,000 page views in 2011 and was reinforced with the @OSU_smallgrains Twitter feed. Hard copies of results were distributed to over 8,000 stakeholders in the state of Oklahoma via direct mailing and to over 600 producers via electronic copy.

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 #8

1. Outcome Measures

Assessing carbon sequestration in Oklahoma

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual

2011 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Intensive tillage has historically been used in Oklahoma to bury wheat residue following harvest. The lack of crop diversity and intensive tillage in monoculture wheat systems in the past has not been conducive to sequestering carbon. In 2004, no-till acreage in Oklahoma was estimated to be 8% by CTIC, approximately 20% behind the national average. Recent estimates have put no-till acreage around 30% of the 9 million acres of cropland in Oklahoma. With the discussion of offsetting greenhouse gas emissions, no-till has been identified as a sink. However, very little data exists for carbon sequestration rates in Oklahoma and the southern Plains.

What has been done
In 2009, the Oklahoma Carbon Program was initiated to help match producers with companies that wanted to offset their carbon dioxide emissions. To ensure the success of the program and maximize benefits for the producers, efforts to quantify and demonstrate the capacity of Oklahoma soils to sequester carbon after no-till adoption or cropland conversion to permanent grass was initiated.

Results
Nearly 10,000 soil samples have been collected across the state to monitor carbon sequestration rates and verify sequestration rates. Since 2009, carbon contracts have been established on 49,000 no-till acres resulting in $71,000 being paid to Oklahoma producers. This is a small portion of the nearly 2.5 million acres of no-till cropland estimated to be in Oklahoma. Through our verification of carbon sequestration rates we can confidently say that we have sequestered 20,000 Mtons of carbon dioxide in these 49,000 acres under contract.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
205	Plant Management Systems

Outcome #9

1. Outcome Measures

Adjustment of earliest insurable planting date for grain sorghum in Oklahoma

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Early planting of grain sorghum can partially ameliorate the effects of heat and drought commonly experienced during the Oklahoma summer. The earliest insurable planting date for grain sorghum in Oklahoma, however, was established by the Risk Management Agency (RMA) as May 1. This planting date frequently pushed grain sorghum development well into Oklahoma?s typical dry and hot summer.

What has been done
Beginning in 1999 the OSU Crop Management Team began experimenting with grain sorghum planting dates in north central and southwestern Oklahoma. Results from these experiments revealed that a late-April planting date offered a 30 to 50% yield advantage over a mid May planting date; therefore, two optimal grain sorghum planting windows in Oklahoma: April 15 to May 1 and June 1 to July 4. From 2003 to 2010 grain sorghum variety trials were sown around the state between April 16 and 29 with no losses dues to freeze. These data were presented to RMA along with a request to move the early planting date to April 15th.

Results
Our work convinced RMA to move the early planting date to April 20 starting in the 2012 production season. Oklahoma grain sorghum producers typically budget for a 90 bu/ac yield if planted in April and our data show a yield loss of 27 to 45 bu/ac can be expected if planted in May. This equates to an increase of 148.50 to $247.50/ac of gross income for producers when sorghum in planted in late April as now allowed by the RMA.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #10

1. Outcome Measures

Best management practices for pasture recovery following drought

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Of the 8 million acres of introduced forages grown in Oklahoma, nearly all were negatively impacted through the excessive heat, prolonged drought, and heavy grazing pressure during the drought of 2010-2011. Even when growing conditions return to normal, lingering effects on pasture recovery related to drought will remain. Most notable of these will likely be reduced persistence, couple with slower regrowth.

What has been done
In early-April, it was clear that forage shortages, including both pasture and hay, would occur during 2011. A series of newsletter articles was published addressing forage management and grazing strategies during drought, in addition to guidelines for purchasing hay. Other articles were developed to dealing with the management of forage nitrate toxicity concerns. During the same time period, drought-related issues were addressed via SunUp. All of these programs resulted in additional requests for supplemental information that was published in many other new outlets, popular press, and web-based publications. A few examples of these are High Plains Journal, Drover?s CattleNetwork, Land and Livestock Post, Progressive Farmer, Cattle Today, Progressive Beef, Oklahoma Farm Report, and KRONEWS. Due to the continued hay and forage shortage, other newsletters were developed to address potential pasture recovery, winter pasture alternatives, and what to expect when purchasing hay from outside sources.

Results
In 2011, the value of lost forage and productivity pasture is estimated at $150 to $200 per acre. A conservative estimate of the total impact based on these valuations is between $ 900 million and $1.2 billion. There was no relevant information available on forage and/or pasture management either during or following drought. Relevant information was developed and synthesized during the fall to meet requested programming needs for Pasture Recovery Following Drought and Pasture Management During Drought.

4. Associated Knowledge Areas

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

Outcome #11

1. Outcome Measures

Assessment of soil nitrate nitrogen reserves as affected by drought.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nitrogen is one of the most costly and environmentally sensitive crop inputs for Oklahoma farmers and ranchers. Crops and pastures damaged by the 2011 drought did not fully utilize soil nitrate nitrogen reserves, thus leaving nitrogen available for subsequent crops. In order to capitalize on this reserve nitrogen, however, a soil test is required.

What has been done
The OSU Soil, Water, and Forage Analytical Laboratory analyzed over 25,000 soil samples for farmers, representing approximately 2 million acres of agricultural land.

Results
An average 30 lbs per acre of nitrate-N was left in the soil profile due to the 2011 drought. Average savings in nitrogen fertilizer costs would be approximately $18 per acre for farmers who took credit for this residual nitrogen. Statewide impact of this nitrogen savings would total approximately $3.6 million in monetary savings in addition to extensive non-monetary environmental benefits from reduced nitrogen fertilization.

4. Associated Knowledge Areas

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

Outcome #12

1. Outcome Measures

Electronic Trading vs. Open Outcry Trading of Hard Red Winter Wheat at the Kansas City Board of Trade

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Kansas City Board of Trade, where hard red winter wheat is traded, now offers side-by-side trading by electronic method or by traditional open outcry in a trading pit. One concern is which market is better for agricultural producers to use? Another question is how are both markets able to survive?

What has been done
A journal article was published in the Journal of Agricultural and Resource Economics that compared liquidity costs in the two markets. Liquidity costs are measured as the bid-ask spread. For small volume traders like most agricultural producers, liquidity costs are lower in the electronic market. The highest volume traders pay lower liquidity costs in the open outcry market and this explains why the open outcry market has been able to survive.

Results
The results show that hard red winter wheat producers are better off using the electronic market. They also show that the exchanges need to address the issue of how to modify electronic markets to better handle large orders.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #13

1. Outcome Measures

Extension Cotton Team Provides Technical Support for Industry During Record Drought Year

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Extension Cotton Team efforts included areas such as IPM and crop crisis management during the entire 2011 growing season. According to USDA-NASS, about 415,000 acres were planted with only about 70,000 acres harvested. This was due to extreme heat and drought conditions. According to USDA-NASS, record heat and drought in 2011 resulted in the lowest cotton production and harvested acreage in Oklahoma since records began in 1894. Production was forecast at 63,000 bales, down 85% from 2010. Estimated 2011 yield was 432 pounds per harvested acre, down from 750 pounds in 2010. Most dryland acres never emerged. Irrigated acreage emerged, but was abandoned beginning in June due to lack of irrigation water from the Lugert-Altus Irrigation District. Other irrigated fields were later released after USDA-RMA approved boll count insurance adjustment procedures in September.

What has been done
Coordination with crop consultants, Extension Educators, and industry representatives resulted in early warnings of potential yield issues because of 4-bract (malformed) square development prone to high shed rate in most irrigated fields by mid-July due to extreme heat. Newsletters focused considerably on crop insurance/trait/seed refund information, initially for dryland fields and later for irrigated. Irrigation termination issues were important in 2011, and many fields had to continue to be irrigated by producers just to protect insurance eligibility requirements. We worked with many producers, insurance agents and adjusters to get irrigation in these fields terminated as soon as practical.

Timely drought management meetings were scheduled for several hardest hit counties including Jackson County (20 producers), Tillman County (61 producers), and Harmon County (13 producers). Crop insurance issues were discussed as well as what to expect in terms of potential crop production. These meetings resulted in the opportunity for hands-on-training for Extension Educators in these counties. Several face-to-face on-site in-service training events were provided

to Extension Educators in their counties in response to producer inquiries. Harmon County: 4 hours in salinity affected fields, 3 hours in irrigation termination evaluation, 3 hours in late season N application/irrigation termination in drip. Jackson County: 3 hours in irrigation termination evaluation. Tillman County: 8 hours in crop condition/irrigation termination/crop insurance issues during tour of 26 irrigated fields in August.

Results

4. Associated Knowledge Areas

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

Extreme drought during 2011 negatively impacted many trials and research plots, as well as prevented many producers from implementing certain practices.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluation data is collected annually on first-hollow stem application by Oklahoma producers. The impact results are noted in state-defined outcome number 1.

Variety trials are conducted annually to estimate the relative production characteristics of new and traditional varieties of wheat. NASS collects data on varieties planted in Oklahoma. The combined statistics can be used to evaluate the acceptance of newer varieties developed with OAES research and that of other states and the estimate the impact of usage on production and income. The impact results under state-defined outcome 4 are based on this information.

Acceptance and performance of new wheat varieties released by OSU are evaluated in the marketplace by the number and/or proportion of total wheat acreage planted to the varieties. OSU wheat varieties are now planted on the majority of wheat acreage in Oklahoma and significant of the acreage in Kansas.

Key Items of Evaluation

Evaluations help us estimate that using first-hollow stem indicator (a research developed criterion and extended through Extension) helps producers reduce lost

production at about $280 million annually from traditional methods.

Producers using a OAES research developed wheat variety that was extended through the Oklahoma Extension Service resulted in a $15 million improvement in gross income for producers in 2011 and over 25 million more bushels available for consumers worldwide as compared to the traditional variety displaced by the newer variety. This occurred despite a year of extreme drought.

In 2008 a survey of Extension educators indicated that sensor-based nitrogen management practices were used on approximately 240,000 acres of winter wheat. This estimate doubled to 500,000 acres of winter wheat and canola in the fall of 2011. According to a recent research study, use of the sensor-based system increases profit in winter crops by approximately $10/ac resulting in a statewide impact of approximately $5,000,000 annually.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Plant Biological Technologies

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
123	Management and Sustainability of Forest Resources	0%		5%	
132	Weather and Climate	0%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		25%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		13%	
206	Basic Plant Biology	0%		14%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		5%	
212	Pathogens and Nematodes Affecting Plants	0%		33%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	7.0	0.0
Actual Paid Professional	0.0	0.0	12.0	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**
0	0	572656	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	572656	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	3161345	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

•Design and conduct research, including the development of methods and procedures •Write and submit grant proposals to private, state and federal agencies •Generate scientific publications - communicating scientific results to a wide range of scientists •Training of professional scientists - graduate and undergraduate students, technicians and post docs in the scientific discipline •File patents

2. Brief description of the target audience

Scientists and scientific societies
Governmental science organizations
Educational institutions
Applied researchers and extension specialists
Students
Private, federal, state, and industrial funding agencies
Other stakeholders (producers, consumers, educators, public)

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 3

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	33	33

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Grant proposals written and submitted

Year	Actual
2011	52

Output #2

Output Measure

- Peer-reviewed publications including journal articles

Year	Actual
2011	33

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Graduate students graduated

Outcome #1

1. Outcome Measures

Graduate students graduated

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Advanced degreed students are required to continue development of society and a major objective of research universities is to train students to use their creativity through the scientific methods to conduct research.

What has been done
M.S. and Ph.D. degree programs are conducted and students mentored in research methods by scientists.

Results
Students matriculate with advanced degrees and move on to careers in science, technology and engineering.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

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

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The majority of the research conducted under this program area is mechanistic in nature and as such the evaluation of the importance and impact of the work is measured in terms of number of high impact peer review manuscripts published and/or number of peer review comptetive grant proposals funded and/or number of patent applications. These are reported under the outputs sections.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Commercial and Consumer Horticulture

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
124	Urban Forestry	6%		10%	
202	Plant Genetic Resources	10%		10%	
204	Plant Product Quality and Utility (Preharvest)	10%		15%	
205	Plant Management Systems	50%		40%	
502	New and Improved Food Products	6%		20%	
901	Program and Project Design, and Statistics	4%		5%	
903	Communication, Education, and Information Delivery	14%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	13.0	0.0	2.0	0.0
Actual Paid Professional	18.0	0.0	3.0	0.0
Actual Volunteer	26.8	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**
300000	0	151676	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
300000	0	151676	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1900000	0	837329	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

•Conduct research to evaluate cultivars of traditional and nontraditional horticultural crops and ornamental plants. •Conduct research into crop cultural systems, particularly the feasibility of horticultural crops in rotation with agronomic crops. •Conduct research to develop "seed to market" production systems for high-value alternative horticultural crops like cilantro and herbs. •Conduct research to develop sustainable and/or organic production systems for commercial horticultural crops. •Provide demonstrations and education and disseminate information to support Oklahoma's commercial horticulture industry, with emphasis on electronic resources. •Survey Oklahoma Consumers (Gardeners) to assess the needs and wants of the gardening public •Upgrade the web-based delivery •Review and revise annually or as needed Fact sheets and other publications. •Educational programs are conducted based on public interest and County Educator requests. •Participate and support eXtension Consumer Horticulture/Master Gardener Community of Practice •Conduct Master Gardener/Junior Master Gardener Training •Conduct pesticide training and education •Assist in Youth at Risk - Obesity/School Gardens

2. Brief description of the target audience

Horticultural crop producers, commodity groups, food processors, landscape professionals, input suppliers such as seed and chemical companies, peer scientists, extension specialists and county professionals, horticultural dealers and merchants, greenhouses, Master Gardeners, home owners, communities, and youth.

3. How was eXtension used?

In 2011 approximately 10 responses were provided by state specialists to users of eXtension through the Ask an Expert feature of the Gardens, Lawns & Landscape Community of Practice eXtension web site. In 2011 the Grape Community of Practice eXtension website was managed by our Oklahoma State University extension fruit specialist. During this period 19 articles were written and posted. The site had 5,149 visits by clientele from 30 different states.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	120155	21065665	6300	200000

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	8	17	25

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- New Master Gardeners trained

Year	Actual
2011	268

Output #2

Output Measure

- Manuscripts submitted for consideration of publication in peer-reviewed journals

Year	Actual
2011	17

Output #3

Output Measure

- Number of Extension publications completed - fact sheets, newsletters, trial reports, web-based materials

Year	Actual
2011	57

Output #4

Output Measure

- Number of statewide "Oklahoma Gardening" shows produced

Year	Actual
2011	36

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of horticultural crop producers newly certified as organic
2	Number of volunteer hours provided to community horticulture programs statewide
3	Number of home gardeners experiencing increased awareness and knowledge about environmental issues and IPM principles
4	Research and extension programming providing for the labeling of new herbicides for use in commercial vegetable production.

Outcome #1

1. Outcome Measures

Number of horticultural crop producers newly certified as organic

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
502	New and Improved Food Products

Outcome #2

1. Outcome Measures

Number of volunteer hours provided to community horticulture programs statewide

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	71167

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Rapid urban growth in many areas of the United States coupled with increased interest in the environment and home gardening have prompted an ever-increasing number of garden and landscape inquiries. Along with this interest, comes a multitude of gardening questions needing individual explanation and too few Extension staff members to answer each question. Many of these questions are seasonal in nature and are relatively easy to answer assuming that one has horticulture training.

What has been done
Oklahoma Master Gardeners are trained, supervised and recruited to: 1) improve overall efficiency in providing one-on-one service to the non-commercial horticulture clientele in the county, 2) provide group learning and teaching activities for non-commercial clientele, 3) allow agents to develop proactive Extension programs, and 4) form a group of Extension volunteers to support additional consumer horticulture efforts.

Trainees participate in a 10 - 13 week course receiving between 40 - 56 hours of course work on subjects including: basic plant science, vegetables, fruits, nuts, ornamentals, lawns, diagnosing pest problems, soils, and other related topics. Upon completion of the training period, satisfactorily passing an exam on materials and topics covered, and donating between 40 - 56 hours of volunteer time to the Horticulture program, the trainees are certified and awarded the title of Oklahoma Master Gardener.

Examples of Master Gardener Volunteer activities include: staffing plant clinics to answer phone and walk-in questions, manning educational exhibits, maintaining demonstration gardens, community beautification projects, serving as 4-H hort leaders and judges, speaking at club/civic meetings, teaching horticulture activities at nursing homes, etc., assisting in horticulture mailings, newsletters, etc., and appearing on TV and radio.

Results
The service from the Master Gardener volunteer program has proven to be a highly popular means of extending the knowledge of the Oklahoma State University Cooperative Extension Service to the residents of Oklahoma. The Oklahoma Master Gardener Program now has 25 counties participating in the program as of January 2012. The following data was provided by 20 of the 25 counties. Approximately 268 new Master Gardeners were trained during the 2011 training season. Close to 1,243 active Master Gardeners volunteered their time, contributing

approximately 71,167 volunteer hours resulting in over 6,489,018 educational interventions with Oklahomans and as many as 1,937+ educational and community programs and activities being conducted in their communities in 2011. This translates to over $1,213,397 in service that was donated by volunteers (wage rate of $17.05/hour was used, which includes a 12% estimate of fringe benefits. This hourly rate is the assigned wage for nonagricultural workers in 2009 for the state of Oklahoma as published by The Independent Sector, an organization that "serves as a national forum to encourage giving, volunteering and not-for-profit initiative," http://www.independentsector.org/programs/research/volunteer_time.html). Reports are gathered yearly at the beginning of the following year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
124	Urban Forestry
205	Plant Management Systems
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Number of home gardeners experiencing increased awareness and knowledge about environmental issues and IPM principles

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	82000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public concern for the environment continues to increase. Traditional landscape management practices have involved extensive use of pesticides, fertilizers, and other materials that could harm the environment if not used properly. Integrated Pest Management (IPM) uses biological principles, cultural practices, and some chemicals to control pest populations with minimal environ¬mental impact.

What has been done
Over 1900 gardening programs and IPM workshops, educational programs/seminars and Oklahoma Gardening segments are used to educate the public of IPM practices and other related

gardening topics. Research in conjunction with the IPM TIP team has initiated work using perennial ornamental plants to attract pollinator and predatory insects to home gardens.

Results
Homeowners are better educated and can make choices in maintaining the landscape that are more environmentally friendly. The impact of the research is that additional pollinator insects and predatory insects should result in greater fruit yield from home vegetable gardens and consumers will use fewer insecticides in their gardens. Also, over 700 green industry professionals received training in IPM and other environmentally-related topics.

4. Associated Knowledge Areas

KA Code	Knowledge Area
124	Urban Forestry
205	Plant Management Systems
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Research and extension programming providing for the labeling of new herbicides for use in commercial vegetable production.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	68000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
When surveyed, commercial vegetable farmers prioritized improved weed control as their number one concern. Hand hoeing of commercial fields is very expensive ($500-800/acre) and hoe crews are difficult to find in the state. Therefore it is necessary to research new herbicides to support registration of these for vegetable production.

What has been done
Research and extension programs have been closely involved with the Oklahoma pepper industry during the past several years. Involvement has included yearly trials of both preemergence and postemergence herbicides with the primary goal of supporting new registrations to reduce hoeing

costs and improve yields in this crop.

Results
During the past twelve months one new herbicide was registered for use in commercial pepper production. The economic impact of approximately $68,000 of this registration includes both savings from reduced hand hoeing costs and increased income from higher yields.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Limited formula funding has reduced the ability to conduct applied research that is targeted at local needs while financial support from industry partners was down due to the economy.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Number of "hits" to extension websites will be recorded. Web sites analyzed will include Oklahoma Gardening You Tube and Facebook sites, OSU horticulture extension publications web site, and other appropriate departmental web sites.

Conference/Workshop participants (commercial and consumer horticulture) will be surveyed post workshop survey via either hard copy survey or on-line survey in order to determine their intent to adopt recommended management practices and IPM techniques conveyed during workshops. Workshop participants will include those from county sponsored programs and state and departmental sponsored programs.

Testing will be conducted for the Master Gardener trainees in regard to their understanding and adoption of best practices for home landscape and garden. Participants of the annual master gardener continuing education conference will be surveyed to determine the knowledge gained and likelihood of adoption of improved management practices learned at the conference.

Yearly reports will be collected from Master Gardener Volunteer programs indicating

number of new Master Gardener Volunteers trained; total hours volunteered (including); number of contacts made with Oklahoma residents; number of educational activities and programs offered; and number of pounds of produce donated to local food banks and non-profit agencies.

Key Items of Evaluation

Cultivar evaluations, screening of herbicides for weed control, and other cultural studies for vegetable and fruit production were evaluated and a majority were reported in the 2011 Vegetable Trial Report MP-164.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Climate Change - Ecosystem and Environmental Quality and Management

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
104	Protect Soil from Harmful Effects of Natural Elements	5%		10%	
111	Conservation and Efficient Use of Water	13%		10%	
112	Watershed Protection and Management	12%		10%	
121	Management of Range Resources	15%		15%	
123	Management and Sustainability of Forest Resources	10%		10%	
133	Pollution Prevention and Mitigation	8%		10%	
134	Outdoor Recreation	6%		0%	
135	Aquatic and Terrestrial Wildlife	9%		5%	
136	Conservation of Biological Diversity	3%		5%	
205	Plant Management Systems	6%		10%	
403	Waste Disposal, Recycling, and Reuse	5%		5%	
605	Natural Resource and Environmental Economics	8%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	8.0	0.0	6.0	0.0
Actual Paid Professional	10.0	0.0	15.0	0.0
Actual Volunteer	2.2	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**
180000	0	687187	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
180000	0	687187	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1100000	0	3793615	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Design and conduct research
- Submit grant proposals
- Produce scientific publications
- Specialty conferences to address environmental issues of concern to Oklahoma,
- An Environmental Quality and Waste Management publications series
- A website that expands upon the information presented in the publication series, providing the range of information
- A high-visibility symposium series will share high quality research and extension programs with technical and lay audiences.
- Poultry Waste Management Education
- Water Quality educational programs

2. Brief description of the target audience

Scientists, students, related agencies (Federal, State, private), land owners, farmers, ranchers, communities, consumers, land developers, state legislators, commodity groups, community leaders

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	15268	420129	4500	36000

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	10	10	20

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Grant proposals written and submitted

Year	Actual
2011	19

Output #2

Output Measure

- Manuscripts submitted for consideration of peer-reviewed publication

Year	Actual
2011	37

Output #3

Output Measure

- Extension conferences, workshops and training sessions

Year	Actual

2011	237

Output #4

Output Measure

- Research and Extension reports and fact sheets

Year	Actual
2011	142

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of poultry producers and poultry litter applicators acquiring initial waste managment certification and number maintaining certification
2	Number of animal waste analyses conducted for land application of beef, dairy or swine waste.
3	Number of animal waste analyses conducted for poultry litter application
4	Peer-reviewed publications
5	Number of users accessing website designed to deliver information about water policy, conservation and efficient use
6	Particulate Matter Sampler Errors - Air Quality
7	Role of Directly Connected Macropores in Pathogen Transport to Subsurface Drainage - Water Quality
8	Subsurface Transport of Phosphorus in Alluvial Floodplains - Water Quality
9	National Cotton Gin PM2.5 Emissions Study - Air Quality

Outcome #1

1. Outcome Measures

Number of poultry producers and poultry litter applicators acquiring initial waste managment certification and number maintaining certification

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1032

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The 1998 Oklahoma Registered Poultry Feeding Operations Act and the Poultry Waste Applicators Certification Act were established in response to concerns about phosphorus from poultry litter polluting important water resources. Specifically, the Eucha-Spavinaw and Illinois River watersheds have been the focus of regional and national attention in regards to litigation and regulation over water quality concerns. As set forth in the Acts, all poultry production operators and poultry waste applicators must complete an initial nine-hour series of Oklahoma Cooperative Extension Service (OCES) Poultry Waste Management (PWM) educational sessions followed by continuing education. In 2011, the OCES PWM Education Program continued to provide the required training, addressing water quality concerns associated with improper or excessive land application of poultry litter. Over 1,000 people participated in the program during 2011.

What has been done
Between January 1, 2011 and December 31, 2011, Cooperative Extension Educators offered the initial nine-hour training sessions five times, educating 72 new operators and applicators. Initial PWM sessions cover basic training on regulations, water quality, animal waste management plans, nutrient management, soil sampling and spreader calibration procedures, conservation practices and poultry litter commerce. A total of 2,518 people have received certificates of completion since the program began in 1998. 2011 pre-test data (test taken before each chapter is presented) shows that 69% of the producers? answers were correct compared to post-test data (test taken after each chapter is presented) which shows that 87% of the answers were correct. Continuing education classes encompass training on environmental protection needs and the latest knowledge and practices for poultry litter nutrient management. Over the past year, OCES developed 10 new presentations to meet educational needs. Continuing education efforts consisted of 65 hours of classroom and field instruction in calendar year 2011. Training efforts can be measured by multiplying hours given in a single class by the number of people attending

that class, resulting in a unit of training called People-Hours. A total of 3,144 People-Hours were given in 2011.
In order to ensure that the Oklahoma Department of Agriculture, Food and Forestry (ODAFF) and OCES staff have the most complete and current records of education received, the PWM education database was completely redesigned in 2011. Developed with assistance from Biosystems and Agricultural Enginnering Information Technology staff, the new database offers a myriad of sorting, viewing, reporting and printing options and contains the complete educational history for over 3,000 past and current poultry operators and poultry litter applicators.
The Poultry Litter Nutrient Management Guide was developed in 2011 and quickly became a vital resource for individuals seeking information about litter use as a fertilizer. Topics covered include: benefits of litter application, environmental considerations, Oklahoma regulations, valuing litter, nutrient management, application timing, best management practices, and litter commerce. The guide is available from County Extension offices, by mail as requested and for download from the PWM website.
Poultry Practices, a biannual newsletter developed for poultry producers, applicators and professionals began publication in April 2011 with a distribution of over 1,000 copies. The newsletter was designed as a further educational resource, providing timely industry, environmental and regulatory topics. The second issue was distributed in November 2011 and both issues have received extremely positive feedback.
OCES developed the OK Litter Market www.ok-littermarket.org website to assist with the transfer of poultry litter to areas of need and away from nutrient surplus areas. The website, which includes a current database of litter buyers, sellers and service providers, assists substantially in promoting the transfer of poultry litter out of Eastern Oklahoma to more distant areas of the state with nutrient-deficient soils. Educational material such as fact sheets, regulatory information, maps of restricted watersheds, and litter fertilizer value calculators are also available which help the user determine the suitability and value of the product. The OK Litter Market website and the PWM website extend the reach of OCES even further, providing resources to an entirely new generation of producers and applicators.
Furthermore, government litter transport subsidies ceased in 2010; however, OCES continued to provide educational training, marketing litter as an alternative fertilizer to farmers and ranchers located outside of nutrient limited watersheds. Over 834 producers were reached at 29 Extension meetings and conferences.

Results
A report of 2010 and 2011 poultry waste production and movement, prepared by the ODAFF, indicates some dramatic positive changes. Due in no small part to the PWM Education Program and the efforts of OCES Educators and Specialists, this is a tremendous example of the impact we have had.

Okla. Illinois River Watershed: 88% of poultry waste exported out in 2010
Total Poultry Waste Production65,010 Tons
Total land application in the Oklahoma Illinois River Watershed7,774 Tons*
Total land application to other Oklahoma locations27,858 Tons
Total exported to Arkansas28,553 Tons
Total exported to Kansas825 Tons

* This is a decrease from 31,664 tons of poultry waste applied in the watershed in 2009

Eucha-Spavinaw Watershed: 90% of poultry waste exported out in 2011
Total Poultry Waste Production48,441 Tons
Total land application in the Watershed4.872 Tons

Total land application to other Oklahoma locations 17,083 Tons
Total exported to other states26,486 Tons

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

Outcome #2

1. Outcome Measures

Number of animal waste analyses conducted for land application of beef, dairy or swine waste.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	103

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Sludge Accumulation in Swine Manure Treatment Lagoons -
For many years engineers have overestimated the rate at which sludge accumulates in swine manure treatment lagoons. Anecdotal evidence, as well as farmers' experience, indicate the sludge blanket grows less than half as fast as the official rates specified in ASABE Standard, ANSI/ASAE EP403.3 -- Design of Anaerobic Lagoons for Animal Waste Management. The standard is codified into regulations in many states, but designers often ignore the standard, exacerbating the image that lagoons are ineffective treatment systems.

What has been done
Many researchers have tried to solve the sludge accumulation discrepancy in the lagoon standard. But, because they did not follow the growth sludge over a long period of time, their findings also overestimate the accumulation rate. This is because sludge does not accumulate linearly. It is hard to find a sludge layer at all during the first year or two after manure is added to

the lagoon. Then, sludge suddenly appears, and growth is rapid for the next 3 or 4 years. After about five years, accumulation slows to a slow, steady rate. Researchers at Oklahoma State University solved this problem by patiently following sludge accumulation in two lagoons treating manure from similarly sized swine breeding farms. Sludge volume was measured every year for a period of 10 years until a predictable pattern emerged. They found that sludge accumulated in a complex, yet repeatable pattern. Taken over the ten year span of the project, sludge accumulated at a rate approximately one-third the rate used in the design standard. The researchers also found that disturbing the sludge blanket causes sludge to accumulate more rapidly than if the sludge is left alone.

Results
Partially due to the results of this study, ASABE revised ANSI/ASAE EP403.4 -- Design of Anaerobic Lagoons for Animal Waste Management. The official sludge accumulation rate for swine manure treatment lagoons was reduced from 3.03 m3 sludge per g TS added to 1.37 m3 sludge per g TS added. In states where this standard is law, swine lagoons designed today will be slightly smaller than they were before. More importantly, with a standard that more closely resembles reality, engineers will accurately design the sludge storage volume of lagoons. As a result, lagoons in the future will be better, more predictable, manure treatment systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
205	Plant Management Systems
403	Waste Disposal, Recycling, and Reuse

Outcome #3

1. Outcome Measures

Number of animal waste analyses conducted for poultry litter application

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	481

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Alternative Manure Technologies Video Series -
Producers are reluctant to adopt new technologies without firsthand experience with the technology. It is particularly difficult to get positive exposure for manure related issues in traditional media. Creative methods are needed to expose producers to useful technologies for handling and treating animal wastes.

What has been done

Eleven videos highlighting innovative manure handling and treatment technologies were filmed, edited, and produced by the Oklahoma Cooperative Extension Service. Videos were uploaded onto the OSU Waste Management Channel on YouTube to maximize exposure of the technologies. Technologies were selected working with partners in Arkansas, Louisiana, Texas, and Nebraska. We specifically sought out producers who have successfully adopted manure handling and treatment technologies on their farms. Technologies filmed were: a subsurface poultry litter spreader; a large-scale, poultry litter bailing operation; a between flock, broiler litter windrowing system; a rotary drum composter for poultry carcass disposal; a "weeping wall" solid-liquid separator for dairy manure; mechanically separated and composted dairy manure solids used as cow bedding; methane gas captured from a covered anaerobic lagoon used to incinerate swine carcasses; a "Biovator" style rotating drum swine carcass composter; lime enhanced precipitation of solids from alligator ranch wastewater; and vegetative treatment systems for feedlot runoff treatment.

Results

In the two years since creation of the YouTube channel, the videos have been downloaded more than 10,000 times. Videos have been downloaded in all fifty states plus Guam and Puerto Rico. In addition to the United States, the videos have been seen by viewers in 146 countries on all continents. More than one third of all downloads were the result of online searches, which shows that the exposure has been consumer driven. Producers are actively seeking examples of manure technology and downloading the videos. Another source of downloads was videos embedded on websites -- manufacturers of equipment added a link from their home website to our videos demonstrating equipment use on-farm.
Awards: The OSU Waste Management YouTube channel and the videos displayed within were given an Educational Aid Blue Ribbon Award for Electronic Delivery by the American Society of Agricultural and Biological Engineers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
205	Plant Management Systems
403	Waste Disposal, Recycling, and Reuse

Outcome #4

1. Outcome Measures

Peer-reviewed publications

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	17

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
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
134	Outdoor Recreation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
605	Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Number of users accessing website designed to deliver information about water policy, conservation and efficient use

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2097

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
605	Natural Resource and Environmental Economics

Outcome #6

1. Outcome Measures

Particulate Matter Sampler Errors - Air Quality

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Various agricultural operations across the United States are encountering difficulties in complying with current air pollution regulations for particulate matter (PM). This non-compliance is costing American agriculture millions of dollars annually in terms of 1) reducing production to achieve compliance, 2) costs of implementing additional air pollution abatement technologies and/or practices, 3) fines, 4) additional testing requirement, and 5) closures. A primary component of this problem is sampler effectiveness or how well current sampling technology performs in estimating PM emissions from agricultural environments.

What has been done
OSU faculty and collaborators from across the United States have conducted research over the past ten plus years to document the errors associated with particulate matter sampling technologies and bring this issue to the US Environmental Protection Agency and state air pollution regulatory agency's attention. Numerous theoretical and experimental studies have been conducted to determine the errors associated with current PM10, PM2.5, and PMcoarse ambient and stack samplers. Theoretical models have predicted that PM10, PM2.5, and PMcoarse ambient air samplers would over-estimate PM concentrations by a factor of 3.2, 14.0, and 3.4, respectively. These models predicted that PM10 stack samplers would over-estimate PM concentrations by a factor of 4.5. Of course these estimates are dependent on the characteristics of the PM emitted from the source. Field studies have indicated that the sampling errors are significantly larger than those predicted by the theoretical models, for example: 1) PM10 ambient sampler errors from a cotton gin field study were 1.6 times greater than those predicted by the theoretical models; and PM2.5 stack sampler errors from a cotton gin field study were 4.4 to 7.7 times greater than those predicted by the theoretical models.

Results
This research could explain why some particulate matter model estimates do not match regulatory receptor site concentrations. This research could explain why some industries that have been required to install additional control technologies for PM10 and PM2.5 have not significantly reduced PM10 and PM2.5 emission concentrations in the immediate vicinity. Wrong facilities being identified as a primary sources. The USDA Agricultural Air Quality Task Force continues to list this topic a priority action item. Groups such as the Delta Group have used the results to explain why their instruments do not meet the EPA?s sampler performance guidelines. This work has received national attention. Articles discussing this work have appeared in 40 plus newspapers and trade magazines. Dr. Buser and collaborators have met and continue to meet with key US Environmental Protection Agency scientists and are currently developing joint research projects to further quantify particulate matter sampler issues and evaluate alternative methodologies for determining agricultural PM emissions. Other industries such as the mining industry have started looking into the quality of current PM sampler technology.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

Outcome #7

1. Outcome Measures

Role of Directly Connected Macropores in Pathogen Transport to Subsurface Drainage - Water Quality

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pathogen concentrations in streamflow are commonly reported as a significant cause of water quality degradation throughout the world. Research has begun to attempt to model pathogen fate and transport, primarily through surface runoff mechanisms. A significant component of pathogen movement to streams commonly identified but not explicitly simulated in many models is pathogen movement to the subsurface, which can be important in several scenarios such as tile drainage systems. As colloidal contaminants, pathogenic bacteria such as E. coli tend to become physically trapped in the soil matrix but can move quickly through soil macropores. In fact, concerns exist about the rapid transport of contaminants, such as pesticides, pathogens, and nutrients, from the soil surface to ground water through macropores.

What has been done
Innovative laboratory column studies were completed to study E. coli transport with artificial macropores. A soil column was packed with loamy sand and sandy loam soils containing an artificial biopore located directly above a subsurface drain. The sandy loam soil was packed using two different methods: moist soil sieved to 4.0 mm and air dried soil manually crushed and then sieved to 2.8 mm. A 1-cm constant head was induced on the soil surface in three flushes: (1) water, (2) diluted liquid swine manure with E. coli 48 hours later, and (3) water 48 hours after the manure. E. coli transport to the drain was observed with either open surface connected or buried biopores.
Soil sorption experiments were performed with both natural and artificial soils to investigate sorption of fecal bacteria on soils treated with swine effluents and to derive a fecal bacteria

sorption model based on soil properties. Sorption of E. coli was investigated using a series of artificial and natural soils treated with swine effluent at varying dilution ratios (i.e., manure effluent concentrations). Sorption tests were performed using the entire collection of the E. coli population as opposed to a specific E. coli strain. As fecal bacteria in swine effluents mainly consisted of attached bacteria as opposed to free cells in suspension, removal of surface bonded E. coli from solution appeared to be controlled by processes occurring in the substrate (i.e., surfaces to which the bacteria attached) as a function of the soil solution pH and ion exchange.
Several spring and fall field experiments were performed at the Iowa State University Nashua Research Experimental Station, including infiltration tests, smoke tests to quantify directly connected macropores, bromide and liquid swine manure application, and monitoring of flows in the drain due to artificial rainfall events. Subsurface drainage water samples were taken for E. coli quantification and bromide concentrations over a 24-hr total sampling time. Empirical analysis of the breakthrough curves from the field experiments were conducted for modeling bromide and E. coli data. In addition, during one field experiment, biopore transport experiments were performed by directly injecting Rhodamine WT and E. coli into two identified directly connected macropores in the no-till experimental plot. Concentrations of Rhodamine WT and E. coli were monitored in the drain flow along with measurements of the infiltration flow rate into the biopore. Analysis and compilation of field experimental results on the influence of directly connected macropores on E. coli transport to subsurface drains has been completed.
This research incorporated fecal bacteria transport and biopore routines into the Root Zone Water Quality Model (RZWQM) to simulate flow and fecal bacteria transport though the soil, to subsurface drainage, and in runoff. The new routines improved RZWQM?s capability to predict rapid flow (e.g., shape of the hydrograph, time to peak, and flow breakthrough; Nash-Sutcliffe efficiency index ranged between 0.65 and 0.75 for model validation) and soil fecal bacteria transport (e.g., absolute error for the simulated event mean concentrations (EMCs) ranged between 4% and 109%). Fecal bacteria transport concentrations were underestimated in some cases but the modified model captured the trend in concentrations observed during the soil column and plot experiments.

Results

Biopores in both laboratory and field experiments have been shown to consistently provide a mechanism for rapidly transporting E. coli into subsurface drains during flow events. Results from the laboratory and field experiments indicated fast breakthrough of bromide and E. coli through directly connected macropores. These experiments are confirming the prominent role of directly connected macropores in transporting E. coli to subsurface drainage water. Thus, liquid swine manure application preceding a rainfall event could be a source of pathogen pollution in tile drains and groundwater. Sorption of fecal bacteria in soils treated with swine effluents as a fertilizer results from complex mechanisms occurring as a function of the effluent constituents, colloid properties, and fecal bacteria population. These influential factors (i.e., manure effluent load, dominant attached bacteria population, and soil dispersion under high effluent concentrations) should be considered when modeling fecal bacteria transport in soils. This research stressed that future work should be conducted with manure sources dealing with the collective E. coli population. This research incorporated fecal bacteria transport and biopore routines into the Root Zone Water Quality Model (RZWQM) to simulate flow and fecal bacteria transport though the soil, to subsurface drainage, and in runoff. The updated model is a simple, prediction tool capable of simulating fecal bacteria transport in runoff and subsurface drainage with and without the presence of biopores.
Research results have been disseminated through a variety of journal and conference publications. An undergraduate student (Emily Matlock) was one of the top three finalists in the KK Barnes Undergraduate Paper Contest through ASABE based on this work. One manuscript was published in 2011, two manuscripts were accepted for publication and will be published in

2012, and one manuscript is currently in review on this work.
Fox, G.A., E.M. Matlock, J.A. Guzman, D. Sahoo, and K.B. Stunkel. 2011. Escherichia coli load reduction from runoff by vegetative filter strips: A laboratory-scale study. Journal of Environmental Quality 40(3): 980-988, DOI: 10.2134/jeq2010.0391.
Guzman, J.A., and G.A. Fox. 2012. Implementation of biopore and soil fecal bacteria fate and transport routines into the Root Zone Water Quality Model (RZWQM). Transactions of the ASABE (In Press).

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

Outcome #8

1. Outcome Measures

Subsurface Transport of Phosphorus in Alluvial Floodplains - Water Quality

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order to protect and enhance drinking water systems and aquatic ecosystems, water managers need to identify critical nutrient source areas and transport mechanisms within a catchment. This information allows the development of effective strategies for reducing contaminant loads. Phosphorous (P) transport has been assumed to take place primarily in surface runoff, although a growing collection of research indicates that subsurface P transport can be significant.

What has been done
Progress to date has investigated the potential of subsurface transport of P along streams characterized by cherty or gravel subsoils, especially the impact of preferential flow paths on P transport. With the subsoils having hydraulic conductivities on the order of 100 to 200 m/d, an

injection test demonstrated that even a sorbing contaminant, such as P, can be transported in significant quantities through the subsurface without significant attenuation (Fuchs et al., 2009). Non-preferential flow pathways (PFPs) appeared to adsorb P from the water and retard P movement. Seepage discharge and transport characteristics were investigated in trench injection tests on an isolated PFP at the Barren Fork Creek site (Fox et al., 2011). The pathway from which the seep originated was a localized zone of relatively clean gravel. The pathway may impact the distribution of water and solutes without surfacing at the streambank and the trench injection system derived transport parameters indicating rapid solute transport to streams. Research progress on the USGS 104(g) national grant continues focusing on gravel outcrops in alluvial floodplains and their scale-dependent impact on contaminant leaching through soils. Innovative plot experiments that combine electrical resistivity imaging have been performed. Infiltration rates were high (0.8 to 70 cm/h) and varied greatly, even within a floodplain. Samples from observation wells outside the plot (0.5 m from the berm) indicated non-uniform subsurface flow. Electrical resistivity imaging was used to identify zones of preferential flow as well as characterize subsurface soil layering. This research is demonstrating that even small floodplains can have heterogeneous flow pathways that can considerably impact the leaching potential of tracers and phosphorus through the soil.

Results

This research has wide reaching implications for how riparian floodplains throughout the world are managed. Billions of dollars are spent annually through governmental programs in North America and Europe to mitigate surface runoff, sediment, pesticide, and nutrient loads through conservation and restoration of riparian buffers. Although these management plans can be effective, this research hypothesizes that subsurface P transport could also be a contributing factor in certain conditions with this transport occurring along focused as opposed to diffuse pathways. Broad-reaching implications extend beyond P; this research will affect the use of riparian buffers for mitigating other contaminants such as nitrogen, pathogens, and pesticides to stream systems. This research may potentially alter the management of riparian floodplains throughout the state of Oklahoma and the United States.

Dissemination of research findings on this objective during the past year have occurred through presentations at local, state, and national meetings and publication of peer-reviewed journal articles and conference proceedings during the project period. Graduate student papers and presentations on this topic have received national recognition (runner-up of the 2011 ASABE Graduate Student Research Award for the Ph.D. division). Four manuscripts were published in 2011 on this work and two additional manuscripts are currently in preparation to be submitted in 2012:

Miller, R.B., D.M. Heeren, G.A. Fox, D.E. Storm, and T. Halihan. 2011. Design and application of a direct-push in-situ gravel permeameter. Ground Water 49(6): 920-925, DOI: 10.1111/j.1745-6584.2010.00796.x.

Heeren, D.M., G.A. Fox, R.B. Miller, D.E. Storm, A.K. Fox, C.J. Penn, T. Halihan, and A.R. Mittelstet. 2011. Stage-dependent transient storage of phosphorus in alluvial floodplains. Hydrological Processes 25(20): 3230-3243, DOI: 10.1002/hyp.8054.

Fox, G.A., D.M. Heeren, R.B. Miller, A.R. Mittelstet, and D.E. Storm. 2011. Flow and transport experiments for a streambank seep originating from a preferential flow pathway. Journal of Hydrology 403(3-4): 360-366, DOI: 10.1016/j.jhydrol.2011.04. 014.

Mittelstet, A.R., D.M. Heeren, G.A. Fox, D.E. Storm, M.J. White, R.B. Miller. 2011. Comparison of subsurface and surface runoff phosphorus transport rates in alluvial floodplains. Agriculture, Ecosystems, and the Environment 141: 417-425, DOI: 10.1016/j.agee.2011.04.006.

Miller, R.B., T. Halihan, D.M. Heeren, G.A. Fox, and D.E. Storm. Geophysical mapping of preferential flow paths in multiple alluvial floodplains. Vadose Zone Journal (In Preparation).

Heeren, D.M., D.E. Storm, and G.A. Fox. A berm infiltration method for conducting leaching tests

at various spatial scales. Journal of Hydrologic Engineering (In Preparation).

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife

Outcome #9

1. Outcome Measures

National Cotton Gin PM2.5 Emissions Study - Air Quality

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In 2006, the U.S. Environmental Protection Agency (EPA) lowered the limit on average PM2.5 emissions over a 24 hour period from 65 to 35 micrograms per cubic meter. Some states have set the standard much lower. This comes from a growing concern that the smallest "dust" particles pose the biggest health threat because they are small enough to penetrate deeply into peoples' lungs. PM2.5 refers to particulate matter less than 2.5 microns in diameter--2.5 microns is about 1/30th of the thickness of a human hair. As states implement required plans to achieve federal standards and begin to regulate industries within their states as part of those plans, they face the major issue of a scarcity or, in some cases, a complete lack of data, on how much PM2.5 the various industries currently emit. Generally speaking, when regulatory agencies have limited data available they will use estimates that are conservative on the side of protecting public health. For the cotton ginning industry, extremely limited PM2.5 is currently available. To meet current federal deadlines, states are utilizing conservative PM2.5 estimates in their state implementation plans. For example, California is currently calculating cotton gin PM2.5 emission rates as of 30% of the total particulate matter emissions. For cotton gins in California, this is a major issue because they will be listed as a significant source of PM2.5 emission within the state and will be

required to install additional costly abatement technologies or shut down to meet the new regulations.

What has been done

Dr. Buser, OSU Assistant Professor in Biosystems and Agricultural Engineering, is leading a multi-state research team that is working closely with the cotton ginning industry and regulatory agencies across the United States. The research team includes: Dr. Derek Whitelock (USDA-ARS Cotton Ginning Research Laboratory in Mesilla Park, NM), Mr. Clif Boykin (USDA-ARS Cotton Ginning Research Unit in Stoneville, MS), and Dr. Greg Holt (USDA-ARS Cotton Production and Processing Research Unit in Lubbock, TX). The cotton gin advisory group consists of approximately 25 members from all cotton ginning associations in the United States, National Cotton Council, Cotton Incorporated, and Texas A&M University. The air quality advisory group consists of about 50 members from the National U.S. Environmental Protection Agency, EPA Region 4 (Atlanta), EPA Region 9 (San Francisco), Texas Commission on Environmental Quality, North Carolina Department of Natural Resources, Missouri Department of Natural Resources, California Air Resources Board, San Joaquin Unified Air Pollution Control District, USDA NRCS Air Quality and Climate Change and other USDA ARS scientists.
This highly collaborative team has conducted PM2.5 stack sampling tests in California, New Mexico, Texas, Missouri, and North Carolina and is on track to submit their research findings in 2012 that will this critical data gap. Preliminary results from the study indicate that cotton gin PM2.5 emission factors are 3 to 6% of total particulate matter emission factors. Although these preliminary results are significantly lower than the conservative California regulatory agency estimates, some cotton gins will be required to implement additional abatement technologies to meet the new regulations, but the costs will be sustainably lower.

Results

If cotton gins are identified as a major PM2.5 emission source, they will most likely be required to install bag houses for all exhausts. The cost for installing this equipment on an average size gin is about $1,350,000 with another $100,000 in annual maintenance costs. If the PM2.5 data gap is not addressed and gins across the country are required to make these changes, it could cost the cotton ginning industry an initial $1.1 billion to make the initial modifications and $85 million per year to maintain the new equipment. This work has received national attention. Articles discussing this work have appeared in 35 plus newspapers and trade magazines. Currently listed as a research priority for the cotton ginning industry. Data will be used in several state implementation plans once the report is released. Permits for the majority of gins in the United States will be updated based on the results of this research.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

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

Drought in 2011 had an effect on several research programs. New program in air quality meant considerably more research in this area.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A report of 2010 and 2011 poultry waste production and movement, prepared by the Oklahoma Department of Agriculture Food and Fiber, indicates some dramatic positive changes. Due in no small part to the PWM Education Program and the efforts of OCES Educators and Specialists, this is a tremendous example of the impact we have had.

Okla. Illinois River Watershed: 88% of poultry waste exported out in 2010
Total Poultry Waste Production..... 65,010 Tons
Total land application in the Oklahoma Illinois River Watershed..... 7,774 Tons *****
Total land application to other Oklahoma locations..... 27,858 Tons
Total exported to Arkansas..... 28,553 Tons
Total exported to Kansas..... 825 Tons

* This is a decrease from **31,664** tons of poultry waste applied in the watershed in 2009

Eucha-Spavinaw Watershed: 90% of poultry waste exported out in 2011
Total Poultry Waste Production..... 48,441 Tons
Total land application in the Watershed..... 4.872 Tons
Total land application to other Oklahoma locations..... 17,083 Tons
Total exported to other states..... 26,486 Tons

Key Items of Evaluation

See above

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Food Safety - Food Processing, Product Storage, and Food and Product Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
216	Integrated Pest Management Systems	8%		5%	
401	Structures, Facilities, and General Purpose Farm Supplies	13%		5%	
403	Waste Disposal, Recycling, and Reuse	6%		5%	
501	New and Improved Food Processing Technologies	20%		10%	
502	New and Improved Food Products	5%		10%	
503	Quality Maintenance in Storing and Marketing Food Products	9%		10%	
701	Nutrient Composition of Food	5%		10%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	10%		10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	14%		25%	
723	Hazards to Human Health and Safety	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	1.3	0.0	4.0	0.0
Actual Paid Professional	2.0	0.0	5.0	0.0
Actual Volunteer	0.1	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**
25000	0	241444	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
25000	0	241444	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
900000	0	1332892	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

•Conduct research that evaluates food processing technologies with the aim of improving food value, quality, and safety. Provide technical applications, demonstrations and education for food processors.
•Develop rapid detection methods for one family of allergens and one bacterial toxin. Pecans will serve as our allergen model while *Staphylococcus* enterotoxin will provide our biotoxin model. Our program will use two approaches. Immunomagnetic affinity and recovery will be used to develop a mechanism to bind and recover allergen- and enterotoxin-derived particles directly. Then a combination of oligo-tagged secondary antibodies and PCR amplification will be used to amplify the detection signal and allow for rapid detection methods. •Conduct research that evaluates agricultural product storage and handling technologies with the aim of improving quality, safety, and costs. Provide technical applications, demonstrations and education for grain and food storage providers and handlers.

2. Brief description of the target audience

food processors, food producers, food handlers, food manufacturers, food safety regulators; and marketers of grain, feed and food;

3. How was eXtension used?

1. a Various articles and fact sheets on eXtension are given as reference and information in extension workshops.
2. Dr. Jones serves as a committee member on the farm safety committee for eXtension
3. 8 articles have been reviewed by the Stored Products Team to submit on eXtension.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1610	7279	30	0

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	26	28	54

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer-reviewed journal articles

Year	Actual
2011	28

Output #2

Output Measure

- Number of conferences and other extension outreach presentations

Year	Actual
2011	99

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Number of processors and/or regulatory agencies implementing new rapid testing methods

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Mycotoxins (aflatoxin, fumonisin) are produced by several genus/species of molds that are ubiquitous to external environments and therefore are potential contaminants to crops and cereal grains, as well as storage areas where animal feeds are stored. One of the most common of the mycotoxins is aflatoxin B1 which is produced by Aspergillus flavus and A. parasiticus. Their growth on crops, notably corn, are partly affected by climate conditions before harvest or may be produced post-harvest on stored crops, grains, hay, or feed that are stored improperly. Feed made from crops already contaminated with aflatoxins will also be contaminated. Aflatoxins can manifest itself by causing aflatoxicosis which can cause adverse affects on the liver and vascular system of livestock and cause blood spots and thin shell formation in eggs. Sensitive and specific detection of the presence of aflatoxins is necessary to prevent the feeding of contaminated crops, grains, and feed to livestock.

What has been done

We have recently devised a method using immunomagnetic capture in combination with PCR for sensitive detection of staphylococcal enterotoxins SEA and SEB down to femtogram levels in complex foods by signal amplification (iPCR-SA). This method was 103-106 fold more sensitive than commercial ELISA methods or iqPCR alone. The method was sufficiently robust that we were able to detect staph enterotoxin spiked, or produced, in complex foods such as ground turkey (Panneerseelan and Muriana, 2009). We are using a similar method that for sensitive detection of Aflatoxins B1, B2, G1, or G2 in animal feeds. By capturing aflatoxin with monoclonal antibodies and detecting with reporter DNA-conjugated polyclonal antibodies on protein-G coated magnetic bead surface, we could quantify aflatoxin as low as 0.1 ppb.

Results

Results from these experiments may serve as a basis for and investigative tool to determine whether foodstuffs or feed stocks are contaminated with aflatoxin. Such a test could be very useful in safeguarding our food supply against mycotoxins, especially as it is understood that levels that are below regulatory action levels (sub-chronic) could still result in illness over the long term.

1.Babu, D., and P.M. Muriana. 2011. Immunomagnetic bead-based recovery and real time PCR (RT iq-PCR) for sensitive quantification of aflatoxin B1. J. Microbiol. Meth. 86:188-194.

2.Babu, D. and P.M. Muriana. 2011. Rapid and sensitive detection of aflatoxin in animal feeds and food grains using immunomagnetic bead based recovery and real-time immuno quantitative-PCR (RT-iqPCR) assay. Ann. Meet. Inst. Food Technol., New Orleans, LA (July 11-14), Abst. # 100-01.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

Number of food processors implementing new technologies or technology improvements

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
High Efficiency Coffee Roaster, Roasters Exchange, OKC - Roasters Exchange needed assistance comparing energy usage of their coffee roasting equipment with their competitor's. The information could be used to dramatically increase sales and market credibility. We embraced this issue and then took on several more.

What has been done
An OCAST grant was awarded to further develop and refine an energy efficient coffee roaster and test it in a variety of experiments, including sensory and operational tests against competitor units.

Results
The project was funded for a total amount of $424,033 (OCAST matching funds of $209,833). Economic impact of the project has been very good. Sales per man hour for Roasters Exchange have increased by 15% since the start of the project. Overall sales, mostly due to the Revelation coffee roaster, have increased by 50%, or $1.4 million. Improved labor use at Roasters Exchange has resulted in a savings of about $120,000, and fourteen new jobs were created at the company since the start of the project. Sensory evaluation has proven that the roaster makes product that results in better tasting coffee compared to previous models and similar equipment made by competitors. A documented energy savings of over 50% compared to competing units was measured. Safety and control of the roaster have been markedly improved. The new roaster design passed California air emissions tests, opening a wide range of new markets. A new web site with a fresh and modern look has been designed and implemented. The Revelation roaster was launched at two international coffee shows (Houston and Hawaii). A spin-off company was started as a result of the OCAST project when the owner of Roasters Exchange purchased a new water-jet cutter for sheet metal parts using the money he saved on this project. The new company cuts metal parts for roasters built by Roasters Exchange and contracts with other companies that need metal-cutting services.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

New products produced

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Watermelon is the leading U. S. melon crop in terms of acreage, production, and per capita consumption. Unfortunately about 20% of the annual watermelon crop is left in the field as culls because of imperfections or undesirable appearance. The opportunity exists to use these culled watermelons in value-added further processed products where the appearance of the watermelon is not an issue. These products could provide an excellent dietary source of lycopene, the pigment responsible for the characteristic red color of tomatoes and watermelons. Lycopene is an antioxidant that may aid in the prevention of certain types of cancers and chronic diseases.

What has been done
We compared methods of watermelon extraction and processing that could be used to develop potential value-added products from watermelon culls and determined the effect of these extraction and processing methods on lycopene concentration, lycopene isomeric form, and final-product antioxidant capacity.

Results
Unfiltered, macerated watermelon tissue had higher concentrations of lycopene than pressed/ filtered watermelon juice. This was true for both heated and unheated juice and macerate samples. Treatments alone or in combination had no effect on lycopene isomeric form. Overall, within the parameters tested, maceration appeared to be a better method for maximizing lycopene recovery from culled watermelons than pressing/filtering.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
701	Nutrient Composition of Food

Outcome #4

1. Outcome Measures

Grain storage, food or pest control entities adopting new process or product

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Oklahoma grain and oilseed producers are faced with increasing pressure to provide to the market not only quantity of product but increased quality. To be responsive to time sensitive market needs and to segregate niche market products, storage at commercial facilities and on the farm must be constructed and managed diligently. To maintain product quality during Oklahoma high-temperature, high-humidity summer conditions, aeration and specific pest management techniques must be employed. Elevator managers must be aware of the latest technology and products available.

The opportunity for oilseed production for marketing to the biofuels industry makes it necessary to store the seed (specifically canola) in Oklahoma until crusher capacity is available for processing. The state has crushing facilities in Oklahoma City now but storage of the seed until it is moved to the crusher is critical. The biofuel and canola oil processing industry demands that canola be available within the state so that processors have less cost to transport the crop from northern United States storage. Oklahoma State University and SPREC have successfully stored canola for extended periods, collected data, and gained the necessary experience to educate Oklahoma producers and elevator managers about the required equipment and techniques for successful storage. If canola is not stored properly, the quality degrades due to fatty acid formulation. This produces an inferior oil product that must be refined, which reduces the price producers receive for their crop. Reporting and advising producers and elevator personnel about how to store canola and assisting in equipment selection is a vital role for the SPREC team. Our research has given us the information required to pass along the appropriate knowledge through extension activities.

On-farm storage has been impacted recently by the requirement that farmers must become certified to fumigate their bins. Increased fuel costs have impacted on-farm storage by placing a higher demand on delivering quality grain to buyers. The increased fuel cost also has affected the use of aeration systems. Hand operated (turned on and off) systems are more costly than

automated aeration systems. Most farms do not have automatic aeration systems, thus, either increasing their electricity costs or resulting in the aeration systems not being used.
With increased restrictions on the use of hydrogen phosphide gas as a grain fumigant, market specifications for products free of insecticide residue, and the ultimate phase-out of methyl bromide as a fumigant for value-added products has spurred research in the area of non-chemical and reduced-chemical management for commodities. Oklahoma State University, along with other university research centers, has produced methods to handle pest infestations in stored products through the use of phosphine and closed loop fumigation, diatomaceous earth and non-chemical application techniques such as temperature control and ozone fumigation. While research has produced excellent results, delivering the applied knowledge to the end user, the producer or commercial storage manager is a challenge that remains. At present, there are no opportunities in Oklahoma for storage personnel to learn about proper storage techniques outside of information and workshops supplied by Oklahoma State University and the SPREC team. Existing fact sheets haven been updated but fact sheets relating to larger bin sizes and new products must be developed.

What has been done
While fact sheets and presentations are common activities of the research and extension specialists in Oklahoma, a concentrated effort by the Stored Product Team needed to be set forth in a manner that addressed the issue more effectively and expediently than normal process allows. The Stored Product Team worked together to offer several new and revised fact sheets and workshops within a two year time period that brought new techniques and updated old ones for Oklahoma producers. A Website has been initiated that provides a portal to a package of information containing fact sheets, publications, lectures, presentations, and access to vital information necessary to prepare Oklahoma for increased storage capacity for new and existing crops. Grain bin safety and entrapment rescue methods have been taught for the first time in the state and will continue to develop into first responder training opportunities for rural community fire departments. A partnership with the Oklahoma State University Fire Protection and Safety Training School has been established so that certification and training can be offered to the State?s fire departments, both paid and volunteer. A new DVD for entry-level workers, on farm storage owners and operators, and first response teams was published in 2011. Partial distribution of the DVD?s has been accomplished with the remainder being sent out in early 2012. These DVD?s will be provided to every elevator and fire department in Oklahoma. Five sets of coffer dams used for entrapment rescue have been tested and analyzed for insertion force requirements and design limitations. Refinement of these testing procedures has been set forth and additional testing of assembled dam designs is now underway for a noted equipment provider.

Results
Thirty five workshops and presentations were offered to Oklahomans in 2011 and 20 in 2010 providing both safety and grain storage instruction. Some of these workshops were recommended to Texas and Missouri managers. In the absence of this kind of expertise in these states, the Stored Product Team extended to them our knowledge through fact sheets and presentations at workshops sponsored by Texas A&M University and University of Missouri. A total of 450 Oklahomans and approximately 150 managers from other states attended workshops in 2011 and 425 Oklahomans attended workshops covering this topic in 2010. A newsletter articles on grain bin safety were published in the Grain Journal with readership of the entire international GEAPS membership. Air quality monitors with the capability of reported 4 different life-threatening gases have been updated and are now in place in all of the WB Johnson elevators in Oklahoma and Texas and the Farmers Coop Elevators in northwest Oklahoma. Hansen-Mueller Grain Company has also purchased monitors based on OSU?s advisement.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems
401	Structures, Facilities, and General Purpose Farm Supplies
503	Quality Maintenance in Storing and Marketing Food Products
723	Hazards to Human Health and Safety

Outcome #5

1. Outcome Measures

Grain Quality Estimation Using Non-destructive Sensing Systems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Canola and other specialty crops such as milo, sunflowers, corn, and forage sorghum are grown by Oklahoma producers as a rotation crops for wheat. Since several of these are oilseeds, canola having the highest oil content, the grading process is different and foreign to most Oklahoma growers and elevator personnel. While the market for canola Oklahoma continues to grow, elevator managers generally buy these crops and directly ship it to entities farther north. Because little storage is available at most local elevators and the market is a direct sale market, the seed must be US#1 grade to be accepted by the elevator. Producers need a quick, inexpensive method to accurately estimate the grade of a sample of their crop before they harvest and transport it to the local elevator. In addition, the ability to determine rancidity in canola and other oilseeds will provide better assurance that quality products with extended shelf life are available to the marketplace. Other constituents should be analyzed quickly and non-destructively to assure top quality pricing.

What has been done
Research using flatbed scanners to characterize properties in flour, soybeans, and milo has shown promise in elementary reflectance based sensing. Extensive research involving hundreds of samples with varying amounts of foreign material and levels of rancidity have been collected and analyzed by the SPREC team and my research program. Correlations using hyperspectral

and electromagnetic sensing have been established and publication of the research is in process. Initial results indicate the new system and procedures will detect factors that lead to rancidity, will be able to detect foreign material in crops objectively, and will estimate free fatty acids.

Results
This method of estimating the grade of specialty crops has the potential of making the difference between a producer selling his crop at the elevator and taking it back home to search for another use for a crop that is not US#1 grade. The estimate of the amount of foreign material may help producers save the unnecessary cost of cleaning the crop before marketing it. Quick, real-time assessment of essential constituents that determine oil and seed quality will help to insure top quality seed is receiving premium pricing and that the crop will store well. With an estimate of 1600 lbs/acre production in the case of such crops as canola, this advantage could total $15/acre. In recent years, more than 50,000 acres were planted to canola alone. This would provide almost another $1M of income to producers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products

Outcome #6

1. Outcome Measures

Grain Bin Safety and Education

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As Oklahoma becomes more involved in the grain-based biofeedstock production industry, more corn and oilseeds will be stored within the state. Statistics show that grain bin entrapment fatalities will increase with the increase in corn and oilseed storage. First responder teams and Oklahoma grain storage personnel, both commercial and on-farm, have very little training or

experience in grain bin safety and entrapment rescue procedures. Within the past three years, two deaths and ten reported accidents occurred in Oklahoma with countless accidents going unreported. Each of these accidents could have been prevented given proper education and safety measures in place.

What has been done

A grain bin specifically designed for providing demonstrations and training on grain bin safety and rescue has been used at the Stored Product Research and Education Center (SPREC) near Stillwater, OK, for onsite training of fire protection and elevator personnel. In addition a consortium of industry representatives, namely WB Johnson, Triangle Insurance, Enid Fire Department, Oklahoma Career Tech and OSU-SPREC, has been organized to produce training opportunities in Oklahoma. A DVD was produced and distributed in 2011. More advanced training has been offered in two separate classes in Enid, Oklahoma. A new high angle rescue tool was designed, a prototype built and presented at the international GEAPS Exchange in February 2011. A partnership with the OSU Fire Protection and Safety Training School has been developed so that expert level training can be provided to fire personnel around Oklahoma and certification processes are in place for this training.

Testing of different coffer dam designs was continued for 6 different manufacturers and results analyzed to compare the amount of force required to insert the dam designs around an entrapment victim. The results indicate that it is not humanly possible for one individual to insert the coffer dams fully assembled. Designs that facilitate easier insertion during an entrapment situation are necessary. Testing procedures to test assembled dams are in place and testing will continue through 2012.

Results

This project will impact the entire rural community of Oklahoma and has been extended to the rest of the US grain industry. The training has the potential of being distributed to other areas of the USA that have intensive corn and oilseed storage requirements. One thousand copies of the new DVD were produced and an estimate of 7000 first responders and elevator workers will view the video in 2011 and 2012. Agreement with the National Grain and Feed Association and Grain Journal is underway to package the DVD with another prescriptive rescue DVD for sale throughout the world.

4. Associated Knowledge Areas

KA Code	Knowledge Area
401	Structures, Facilities, and General Purpose Farm Supplies
723	Hazards to Human Health and Safety

Outcome #7

1. Outcome Measures

Additional Impact Statement for State Defined Outcome Number of food processors implementing new technologies or technology improvements

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Oklahoma Wildlife Department (ODW) runs a paddlefish research program that benefits the species and anglers and provides income to the department. Expansion is needed due to the great success of the program.

What has been done
Four years ago OSU FAPC helped the ODW design a mobile facility that processed (filleted) paddlefish for anglers and harvested caviar that could be sold by the state. The facility was a huge success and popularity of the fish and need for the services provided exploded. Based on the original research and development that went into the mobile processing unit, a fixed facility was designed, constructed and opened in 2011.

Results
A new, fixed, 5,000 ft2 processing facility was built in Twin Bridges. The facility has a capacity of up to 750 fish in a single day (the mobile facility was designed for 225 and could handle up to 500 fish/day). Now the mobile facility can be relocated to a new area and will serve another subset of the paddlefish and fisherman populations of Oklahoma. The facility operates two to four months per year and employees about 15 persons and serves thousands of anglers from Oklahoma and around the world.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products

Outcome #8

1. Outcome Measures

Additional Impact Statement for State Defined Outcome - New products produced

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The acreage of blackberries being grown in Oklahoma is increasing. Most blackberries are being grown as a fresh-market crop, but there is continued interest in producing value-added blackberry products from excess crop production. However, knowledge and experience with respect to which cultivars are best suited for production and best processing practices are lacking. With this knowledge in hand, the regional market for value-added blackberry products could be significantly expanded, thus creating new products, increased sales, and expanded employment.

What has been done
A novel partially-fermented blackberry beverage was produced using a process modified from traditional Korean practices that involve a natural fermentation of a mixture of fruit, leaves, and added sugar. Qualitative tests such as pH, titratable acidity, and percent soluble solids were conducted on the product at various stages in production as well as on the final product.

Results
The process resulted in a sweet beverage that contained around 2% alcohol and a pleasant blackberry flavor. Based on our preliminary experience, we believe that total sugar content of the starting mixture may be critical for achieving the desired fermentation. A suitable microbial inoculum may also help to promote product consistency and quality. However, the blackberry cultivars commonly grown in the Midwest appear to be very suitable for the production of this product. This knowledge lays the groundwork for further development of this type of value-added blackberry product, which has potential marketability as a beverage and a dietary supplement.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

502 New and Improved Food Products

Outcome #9

1. Outcome Measures

Additional Impact Statement for State Defined Outcome Number of food processors implementing new technologies or technology improvements - Antimicrobial interventions for non-intact beef

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Shiga-toxin producing E. coli (STEC) is a potentially deadly pathogen that gained national attention after the 1993 Jack-in-the-Box outbreak. E. coli O157:H7 has since been the predominant focus for food safety interventions on raw beef. Because of the significance of this organism, USDA-FSIS declared it as an "adulterant" on raw ground beef and on beef carcasses. In order to provide tender cuts of beef preferred by consumers, much of the intact beef in the US available at supermarkets and restaurant chains is mechanically tenderized by blades, maceration, injection, or vacuum-tumbled, each of which may allow entry of surface STEC E. coli O157:H7 into previously sterile internal portions of meat (i.e., non-intact). The internally-translocated STEC strains may survive a consumer cooking preference of "rare" and lead to foodborne illness.

What has been done
We have collaborated with Ross Industries, a leading supplier of blade tenderizers to the raw meat industry and they are fast establishing themselves as concerned equipment providers addressing food safety issues by integrating antimicrobial spray intervention equipment into each of their new models of blade tenderizers. We initiated a consortium project with 10 suppliers of antimicrobial chemicals to evaluate 14 antimicrobials against E. coli O157:H7 on raw beef. Fourteen antimicrobials were sprayed onto E. coli O157:H7-inoculated lean beef discs and plated within 1-hr, 1-, 7-, and 14-days to evaluate their antimicrobial efficacy after various treatment periods. The seven most effective antimicrobials were then used to spray surface-inoculated beef subprimals (12-14 lb) prior to blade tenderization. Beef cores (2? diam) were recovered, sanitized, sectioned, blended, enriched, and plated for presence/absence of E. coli O157:H7.

Results

Tests with inoculated lean beef discs demonstrated different levels of efficacy among the 14 antimicrobials tested. Seven antimicrobials were further tested with actual blade tenderization spray treatments of beef subprimals. The data demonstrated that data with actual blade tenderization agreed with data obtained from spray treatments of lean beef discs. The data showed that AvGard XP (sodium metasillicate), the most effective antimicrobial in the Phase 1 trials with inoculated lean beef discs was also superior in actual blade tenderization treatments whereby only 1 of 16 core sections was positive after spray treatment vs 15 of 16 among the controls. The remaining antimicrobials were showed various (lesser) degrees of effectiveness, but all were still better than the controls. The data should identify antimicrobials that may be used in conjunction with mechanical tenderization to provide antimicrobial interventions necessary for USDA-FSIS approval of intervention processes for non-intact beef processes.

1.Spillner, W., P.M. Muriana, and D. Smithyman. Evaluation of 14 antimicrobial intervention solutions sprayed against E. coli O157:H7 inoculated onto beef (Phase 1) and of 7 solutions during blade tenderization (Phase 2). National Meat Association MEATXPO?11, Las Vegas, NV, Feb. 14, 2011.
2.Morgan, J.B., J. Eager, B. Wellings, K. Kushwaha, P. Muriana, J. Nelson. 2010. Integral antimicrobial intervention solution application systems on Ross blade tenderizers. AMSA, Reciprocal Meats Conference, Texas Tech University, June 20-23, 2010, Lubbock, TX.
3.Morgan, J.B., J. Eager, B. Wellings, K. Kushwaha, P. Muriana, J. Nelson. 2010. Integral antimicrobial solution application systems on Ross blade tenderizers ? Phase 1 results. North American Meat Processors Association conference, Sept. 28-29, 2010, Chicago, IL.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #10

1. Outcome Measures

Antimicrobial interventions for vegetables and produce

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2011 1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
STEC E. coli O157:H7 have also been a problem with vegetables and produce as a result of surface contamination either by improper composting, use of raw manure, contaminated irrigation water, wild animal droppings during crop foraging, runoff from nearby animal grazing fields, transfer to crops/ vegetables by birds/insects, or other unknown methods. Reduction of STEC surface contaminants during post-harvest processing of fresh/cut vegetables should reduce risk and outbreaks from these organisms. There have been many large nation-wide outbreaks involving produce in recent years.

What has been done
Fresh carrots (Daucus carota L. cv. sativus), grape tomatoes (Lycopersicum esculentum Mill), cabbage (Brassica oleracea L.), peppers (C. annuum), and spinach (Spinacia oleracea L.) were purchased from a local supermarket and dip-treated in 3 different concentrations of various antimicrobials and each at 3 different treatment times. The antimicrobials included hypochlorous acid (i.e., electrolyzed water), lactic acid, peroxyacetic acid, sodium thiocyanate, and combinations of these antimicrobials. An important feature of this work is that the produce was evaluated based on an equivalent surface treatment area and not by weight, as the surface is the antimicrobial-reactive surface that is of importance during effective treatment.

Results
Our results demonstrated that a standardized surface area will better reflect the relative effectiveness of different antimicrobials on various types of produce than evaluation based on weight since the source of bacteria affected during treatment is the surface. All dipping solutions tested in our study were capable of reducing microbial populations to some extent, but, the antimicrobial effects were dependent on concentrations, treatment times, and types of produce. Electrolyzed water (50 ppm), with a 1 min dipping treatment time, may be effective in reducing microbial loads from some food produce surfaces whereas other types of produce may require higher levels and/or longer treatment times. Lactic acid was tested in combination with electrolyzed water and performed well in reducing bacteria on food produce surfaces at lower levels of lactic acid or hypochlorous acid than when either was used alone. The bactericidal activity of hypochlorous acid is more pronounced on firm "skin" (grape tomatoes) than rough "skin" (baby carrots) vegetables.

1.Jiameng Wang (M.S. thesis, May, 2011). Evaluation of hypochlorous acid (electrolyzed water), lactic acid, and peroxyacetic acid as sanitizers for fresh vegetables.
2.Wang, J.M., and P. M. Muriana. 2011. The use of hypochlorous acid, lactic acid, and peroxyactic acid on the reduction of microbial loads on fresh produce at 3 different dwell times. FAPC Res. Symp., Feb. 22, Stillwater, OK.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #11

1. Outcome Measures

Evaluation of antimicrobials against E. coli O157:H7, Salmonella spp., and Listeria monocytogenes using a kinetic inhibition assay

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There are numerous antimicrobials identified annually for potential use against particular foodborne pathogens. Although there are numerous papers demonstrated efficacy of one inhibitor over another, they are done by different labs, under different conditions, method of application, on different strains, and other varying conditions (between various studies) such that comparative evaluation across studies is difficult at best.

What has been done
Using a multiwell plate chamber for assessment of various antimicrobials via kinetic inhibition assay by following growth (i.e., inhibition) using a microplate reader, we conducted a validated assessment of individual and combinations of antimicrobials for use against mixed-strain 'cocktails' of foodborne pathogens (4 strains of E. coli O157:H7, 6 serotypes of Salmonella spp., and 5 strains of Listeria monocytogenes). The process allowed a simultaneous and organized fashion of evaluation to identify the MIC against the various pathogens and allowed a better understanding of the head-to-head effectiveness of the antimicrobials which may affect better choices in their selection for application in foods trials as food processing interventions.

Results
The MIC of acetic acid, AFTECTm, AvGard XPTm, citric acid, CytoguardTm, lactic acid, lauric arginate, peroxyacetic acid, Purac XTendTm, and Syntrx 3300Tm was evaluated against mixed-strain cocktails of the 3 types of pathogens. The data identifies the levels of antimicrobial that gives slight and complete inhibition of the various pathogen cocktail mixtures. Our research suggests that, the antimicrobial efficacy at a lower use concentration and consequently offers a cost saving for the food industry.

1.Camilla Bottini (M.S. thesis, Dec., 2011). Evaluation of antimicrobials against multi-strain cocktails of Salmonella, Escherichia coli O157:H7, and Listeria monocytogenes using a kinetic

growth inhibition assay.
2.Bottini, C., and P. Muriana. 2010. Evaluation of antimicrobials allowed for use in meats against multi-strain cocktails of Salmonella, Escherichia coli 0157:H7, and Listeria monocytogenes using kinetic growth inhibition assays. FAPC Res. Symp., Feb. 16, Stillwater, OK.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

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
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Government regulations for worker safety and OSHA standards provided challenges to producers and handlers in this industry. The demographics of workers coming into the industry has changed from rural raised workers to non-informed workers, thus creating even more difficulties in workplace handling of products. Competing program priorities within the OSU system provides extra challenges for this team to continue research in this area. The location of research outside of Oklahoma has provided extra challenges in obtaining funding and providing leadership in Oklahoma through this team.

Limited formula funding has hindered our ability to conduct applied research and technical assistance projects. In addition, financial and in-kind support from industry partners has been flat or in some cases has dropped as a result of the extended economic downturn.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

An impact study concluded that companies assisted by team members created a total

of approximately 180 new jobs and saw a total annual revenue increase of about $217 million. Extension and outreach programs were evaluated based on before and after assessment of student knowledge.

Key Items of Evaluation

An impact study concluded that companies assisted by team members created a total of approximately 180 new jobs and saw a total annual revenue increase of about $217 million. Extension and outreach programs were evaluated based on before and after assessment of student knowledge.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Family Resiliency and Economic Well-Being and Human Nutrition and Health

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
602	Business Management, Finance, and Taxation	9%		0%	
607	Consumer Economics	14%		0%	
724	Healthy Lifestyle	5%		0%	
801	Individual and Family Resource Management	30%		0%	
802	Human Development and Family Well-Being	37%		0%	
806	Youth Development	5%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	40.0	0.0	0.0	0.0
Actual Paid Professional	23.0	0.0	0.0	0.0
Actual Volunteer	20.8	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**
450000	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
450000	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2630000	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

•Expansion of public awareness of programs and resources through promotional and educational materials; distributed to teachers, agency professionals, and other community members.

• Presentation of classes released through marketing plans including; One-on-One, News Releases/TV/Radio, Participation in Events, and Displays

•Provide training and other staff development opportunities to county educators

2. Brief description of the target audience

Youth, children; parents; teachers; adult volunteers; middle to low income families; race and ethnicity will also be recognized as an identifier of audiences; caretakers, agencies & service providers, schools, policy makers.

3. How was eXtension used?

The Healthy Oklahoma team was introduced to the eXtension Families Food and Fitness Community of Practice during training and utilized the site references as a resource.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	13253	7053371	15500	500000

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

Patent Applications Submitted

Year: 2011

Actual: 2

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	4	0	4

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Revised online curriculum

Year	Actual
2011	2

Output #2

Output Measure

- Promotional materials and marketing campaign

Year	Actual
2011	7

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Participants demonstrate improved food, nutrition, and/or physical activity behaviors
2	Participants will utilize recommended financial management practices
3	Participants will expand their knowledge of recommended financial management practices including a reduction in their debt levels and the use of credit.
4	Participants in assest building classes (i.e. investments, retirement, home-buyer education, entrepreneurship) will expand their knowledge on home-buying and maintenance, investments and retirement, and starting a busines.
5	Participants will have reduced their debt levels, their use of credit, feel more satisfied with and less stressed about their financial situation, and begin developing an asset base.
6	Participants in assest building classes (i.e. investments, retirement, home-buyer education, entrepreneurship) will have bought a home, started and investment account, started a retirement account, or started a business or have made a conscientious decision not to do so at the current time because of other financial priorities.
7	Adults receiving the program will attain increased interpersonal cognitive problem-solving skills
8	Adults receiving the program reporting increased use of interpersonal cognitive problem-solving skills with children/youth
9	Children and youth receiving the program will increase use of interpersonal cognitive problem-solving skills

Outcome #1

1. Outcome Measures

Participants demonstrate improved food, nutrition, and/or physical activity behaviors

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	759

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over the past decade, the percentage of those overweight has steadily increased in Oklahoma. As many as one in five Oklahoma children are at-risk of being overweight or obese; and two-thirds of adults are overweight or obese. Among children and adolescents, overweight increases the risk of type 2 diabetes, high blood pressure, and cardiovascular disease. The health of Oklahoma youth can be improved by increasing knowledge, skills, attitudes and behaviors related to food and physical activity. Overweight, obesity and associated health problems have a significant economic impact. The estimated annual cost of overweight and obesity in the United States is $117 billion. Just a 10% sustained weight loss has been estimated to reduce an overweight person?s lifetime medical costs by $2,200 to $5,300.

What has been done
Nutrition Education for Youth
The OCES Healthy Oklahoma Impact Team (HOIT) educates Oklahoma youth on healthy food, nutrition and physical activity behaviors with the aim of reducing overweight and risk for related chronic disease. Efforts are conducted primarily in elementary classroom settings across the state using a six lesson series. Topics include increasing consumption of breakfast, using nutrition facts labels to make healthy snack choices, making healthy choices when eating out, making healthy beverage choices, increasing intake of dairy foods, fruits and vegetables, and increasing time participating in physical activity. Lessons are aligned with the Oklahoma Priority Academic Student Skills (PASS).

Steps to a Healthy Oklahoma
To increase physical activity levels of Oklahoma youth the OCES HOIT has developed thirteen supplemental teacher lessons combining nutrition education and physical activity. Lessons are aligned with PASS.

Farm to You Exhibit
OCES programs targeting youth populations joined efforts with State agencies and agricultural commodity organizations to offer an interactive educational exhibit linking agriculture as the source of nutrient dense foods and role of these foods to health. The collaborating programs and agencies include OCES HOIT, OCES Community Nutrition Education Program (CNEP), OCES 4-H, OCES Ag in the Classroom, Oklahoma State Department of Health WIC Service, and Southwest Dairy Farmers. Exhibit messages are consistent with and enhance the HOIP and CNEP youth program messages, are research based and consistent with United States Department of Agriculture (USDA) Dietary Guidelines for Americans 2005 and MyPyramid.

Results
Since September 2008, the Farm to You exhibit was experienced by approximately 56,944 youth and 2,230 community volunteers in 56 counties. The average number of students reached per site visit over the 3 year period was 312 students and 12 community volunteers. In a case/controlled evaluation, the exhibit was found to enhance behavior change in students who were exposed to both classroom nutrition education lessons and the exhibit compared to those exposed solely to the classroom lessons. The project received national attention by being featured in Weighing the Options: How Can We Encourage Healthy Weights among America's Youth, a publication of the National Issues Forum Network, West Virginia Center for Civic Life. In 2010, it received the Dr. Rodney Huey Memorial Champion of Oklahoma Health Award.

The HOIT reached a total of 16,599 youth through school classroom nutrition education efforts. Important improvements in food, nutrition and physical activity behaviors were observed among participating Oklahoman youth which can have a role in reducing overweight and risk of related chronic diseases. The statistically significant observed improvements include:
?33% increase in eating whole grain breads and cereals.
?27% increase in eating fruits and vegetables.
?27% increase in drinking milk or eating cheese or yogurt
?32% increase in eating low-fat meats
?33% increase in eating foods from 2 or 3 MyPyramid food groups for breakfast.
?29% increase in snacking only when hungry.
?39% increase in using nutrition facts labels to make food and beverage choices.
?34% increase in eating small amounts of high fat foods.
?34% increase in eating small amounts of sugar-sweetened beverages.
?23% increase in time spent in physical activity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Participants will utilize recommended financial management practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	15803

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Economic indicators in Oklahoma, such as personal income are holding steady. Only modest job gains were made in 2011 and the unemployment rate is 6.7%. However many families are struggling to make ends meet due to increases in health insurance rates and fuel costs. Increasingly, the aging population is taking on more credit card debt. Many Oklahomans? find themselves in peril of legal action and excessive fees because they employ more disruptive financial practices like payday loans and bogus check writing.

What has been done
Since 2007 extension educators in 14 counties have offered a financial literacy program for persons involved in dire financial circumstances like bankruptcy. In January of 2008 District 6 county extension educators began offering this program to court-ordered bogus check writers. In this region, the number of checks that are written on accounts with insufficient funds totals more than 6,000 in a year. These bogus checks cost merchants and consumers as costs are passed on. The Region 6 District Attorney?s office requested a partnership to deliver financial management classes to offenders in the District 6 counties: Grady, Caddo, Jefferson and Stephens. The program, Making Sense of Money Management has been offered 26 times since 2008. These counties have seen a 40% drop in bogus check

Each member of the Family Economic Well Being Impact team dedicates 28 days to focus on financial literacy related programming. This includes offering diverse classes such as life skills education leading to employment, homebuyer education and basic money management and credit.

Results
This program has been expanded and is supported by 4 judges and 2 District Attorneys. The

program prevents incarceration of the fraudulent check writers. In addition, the court waives the $198 fee for participants who complete the program. During 2011, 105 participants completed the class reflecting a savings to them of $20,790. Comments from participants indicate that they could have avoided their current situation if they had had the information presented in the classes. Members of the impact team reported 572 financial management programs were offered during 2011 with 15,698 participants. Forty-six percent of participants report that they intend to make changes to their financial management practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
607	Consumer Economics
801	Individual and Family Resource Management

Outcome #3

1. Outcome Measures

Participants will expand their knowledge of recommended financial management practices including a reduction in their debt levels and the use of credit.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	4157

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The 2008 Jumpstart Coalition for Personal Financial Literacy survey reflected that financial literacy scores for high school students were lower than their peers tested in 2006. High school seniors only answered 48.3 percent of the questions correctly. For example, only 48% answered correctly that a credit card holder who pays only the minimum payment on a credit card balance would pay more in annual interest charges than someone who paid the balance in full each month.
Lacking basic financial knowledge will costs these students in the long term. Oklahoma has passed legislation requiring that high school students have training in financial literacy before graduation. The Passport to Financial Literacy requirements will affect students who will graduate in 2014. They are required to be literate in 14 topic areas outlined in the legislation.

What has been done
Extension educators on the Family Economic Well Being impact team offer programs targeting youth audiences including high schools. The High School Financial Planning Program offered through the National Endowment for Financial Education offers free materials to instructors and students addressing 11 of the 14 topic areas required by the Passport for Financial Literacy. Reality Check is a program developed by the Jumpstart coalition which according to their website is a quick, easy and free online resource designed to help young people see what it's really going to take to live independently as an adult consumer.

Results
Since the High School Financial Planning Program was revised in 2007 the materials have been provided to over 28,000 students in Oklahoma with 4,157 in 2011. Additionally, all county educators are made aware of the availability of these materials and how they can be used to make connections with schools in their counties. Educators have used the Reality Check materials with 848 students in 9 schools.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
607	Consumer Economics

Outcome #4

1. Outcome Measures

Participants in assest building classes (i.e. investments, retirement, home-buyer education, entrepreneurship) will expand their knowledge on home-buying and maintenance, investments and retirement, and starting a busines.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Participants will have reduced their debt levels, their use of credit, feel more satisfied with and less stressed about their financial situation, and begin developing an asset base.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	15698

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With the idea of paying in cash or with savings beginning to dwindle away in American society it is important that there be help offered to those who do not have the financial know how to begin to free themselves from the burden of debt. This has been noted not only in the rise of student debt but even among senior citizens. In a recent study there was a 28% rise in the use of debt among 65 and older.

What has been done
Extension educators, along with invited speakers, have lead a variety of financial management classes around the state. These classes have had focuses of helping young urban workers to the elderly rural population, and work towards giving those participants a stronger financial base off of which to work towards financial freedom.

Results
For the reported participants, 32% report that they have reduced their debt levels, 17.3% report that they are satisfied with their current financial situation while 11.3% report they feel above average stress about their current financial situation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
607	Consumer Economics
801	Individual and Family Resource Management

Outcome #6

1. Outcome Measures

Participants in assest building classes (i.e. investments, retirement, home-buyer education, entrepreneurship) will have bought a home, started and investment account, started a retirement account, or started a business or have made a conscientious decision not to do so at the current time because of other financial priorities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	815

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There has been a slowdown in the housing market and an increase in home foreclosures. This trend decreased slightly in to 2.3% in 2011, but late housing payments were only slightly less than the national average at 7.8%. Purchasing a home represents the largest outlay of cash for most Americans and many view owning a home as an investment. In Oklahoma during 2011 the number of homes sold had increased, assisted by record low interest rates on mortgages in 2009.

What has been done
Since 2001, Oklahoma Cooperative Extension Service has worked with various agencies in the state in a collaborative effort to provide standardized homebuyer education to potential homebuyers. Research shows that homebuyer education and counseling lowers the incidences of foreclosure. Fourteen extension educators have been trained and certified to deliver homebuyer education programs. Eight hundred and fifteen individuals received homebuyer education from these educators thus providing them with the information they need to make good decisions about home purchase and homeownership.

Results
Thirty three percent of participants in classes actually report purchasing a home. In cases where they give reasons for not purchasing a home 43% state the reason as recognizing they need to work on their finances.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
607	Consumer Economics
801	Individual and Family Resource Management

Outcome #7

1. Outcome Measures

Adults receiving the program will attain increased interpersonal cognitive problem-solving skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	286

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
High risk behaviors in children and youth are serious concerns for everyone. Oklahoma high school dropouts in 2011 numbered just over 5,000 (OK Institute for Child Advocacy). Arrests of juveniles in Oklahoma numbers near 19,000, while babies born to teens number near 6,500 (Oklahoma State Bureau of Investigation). Issues that have been consistently addressed include the number of teens engaging in tobacco use, sexual activity, and weapon carrying because they are above the national average (OK Youth Risk Behavior Survey). The many harmful or unhealthy risks encountered by families, children and youth can impact long-term productivity, healthy functioning, and costs to communities and the state. Research has identified specific protective factors which have a positive influence on young people?s lives however, the average youth experiences less than half of these critical assets (Search Institute).

What has been done
Since 2007, the I Can Problem Solve program (ICPS; Shure, 2000) has been implemented by the impact team. During 2011, Extension Educators in 3 counties recruited preschool or elementary school teachers with a class of children ages 3 through 12 and provided training and technical support on the ICPS program. Eight group teacher trainings and 3 individual teacher trainings were provided and 17 teachers were provided individual consultation. A related program Raising a Thinking Child, which works with parents/ adults in order for them to understand the need to guide their children and allow them to solve problems themselves was also presented to 2 small groups of parents.

Results
Through programs offered by the Family Resilience Team adults and educators have had the opportunity to learn more about themselves and how problem solving can aid them in their work or at home. The Character Critters program reached 250 students. The strong anti-bullying rhetoric that has grown exponentially in recent years and has been something that the FRT has already worked with for several years and through their Bullying program they have been able to reach nearly 250 students.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being

Outcome #8

1. Outcome Measures

Adults receiving the program reporting increased use of interpersonal cognitive problem-solving skills with children/youth

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	286

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
High risk behaviors in children and youth are serious concerns for everyone. Oklahoma high school dropouts in 2011 numbered just over 5,000 (OK Institute for Child Advocacy). Arrests of juveniles? in Oklahoma numbers near 19,000, while babies born to teens number near 6,500 (Oklahoma State Bureau of Investigation). Issues that have been consistently addressed include the number of teens engaging in tobacco use, sexual activity, and weapon carrying because they are above the national average (OK Youth Risk Behavior Survey). The many harmful or unhealthy risks encountered by families, children and youth can impact long-term productivity, healthy functioning, and costs to communities and the state. Research has identified specific protective factors which have a positive influence on young people?s lives however, the average youth experiences less than half of these critical assets (Search Institute).

What has been done
In 2011 ICPS was implemented in 10 classrooms or groups in 5 schools/childcare sites. This implementation has helped a number of children statewide understand that there are other ways of working through or solving our problems that do not involve violence. Through teacher/adult training more and more students can be helped and the message can spread more easily.

Results
Impact evaluation questionnaires submitted by 11teachers, counselors, child care providers, and youth workers with classrooms or groups that received or utilized ICPS indicated:
?64% reported ?much? or ?very much? having changed practices and interactions with the children/class as a result of the program and another 36% ?moderately? changed.
?72% reported ?much? or ?very much? using the skills learned through this program and another 18% ?moderately? used.

?100% rated the overall effect of this program on the teacher?s practices and interactions as ?somewhat good? or ?very positive?.
?100% rated the likelihood of using this program again in the future as ?very positive?.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

Outcome #9

1. Outcome Measures

Children and youth receiving the program will increase use of interpersonal cognitive problem-solving skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1187

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
High risk behaviors in children and youth are serious concerns for everyone. Oklahoma high school dropouts in 2011 numbered just over 5,000 (OK Institute for Child Advocacy). Arrests of juveniles in Oklahoma numbers near 19,000, while babies born to teens number near 6,500 (Oklahoma State Bureau of Investigation). Issues that have been consistently addressed include the number of teens engaging in tobacco use, sexual activity, and weapon carrying because they are above the national average (OK Youth Risk Behavior Survey). The many harmful or unhealthy risks encountered by families, children and youth can impact long-term productivity, healthy functioning, and costs to communities and the state. Research has identified specific protective factors which have a positive influence on young people?s lives however, the average youth experiences less than half of these critical assets (Search Institute).

What has been done
Trained teachers, child care providers, counselors, and youth workers utilized the ICPS program in preschool centers, Head Start centers, elementary schools, and afterschool programs. Some

county educators also co-facilitated or directly presented some of the lessons to children in the classrooms. This has allowed for not only a limited amount of trained personnel to travel the state and provide these programs but for people all over presenting these programs to their communities. Through ICPS, RTC, Character Critters, Bullying these programs have reached a total of 678 children and youth by trained teachers or volunteers, 509 by educators, and a total of 286 adults

Results
Impact evaluation questionnaires submitted by 11 teachers, child care providers, counselors, and youth workers with classrooms or groups of children who received ICPS indicated:
-91% of the children are using the skills learned through this program moderately or much.
-73% of the children are using the language of the program moderately or much.

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

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
- Populations changes (immigration, new cultural groupings, etc.)
- Other (community/school support access)

Brief Explanation

Difficulty with initial explanation of program, keeping the attention of younger children, volume of material to present and time constraints were reported as challenges to program implementation.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Healthy Oklahoma Impact Teamreached a total of 759 in 2011 youth through school classroom nutrition education efforts. Important improvements in food, nutrition and physical activity behaviors were observed among participating Oklahoman youth which can have a role in reducing overweight and risk of related chronic diseases. **The statistically significant observed improvements for 2011 include:**

- 28% increase in eating whole grain breads and cereals.
- 31% increase in drinking milk or eating cheese or yogurt
- 34% increase in eating low-fat meats
- 36% increase in eating foods from 2 or 3 MyPyramid food groups for breakfast.
- 39% increase in using nutrition facts labels to make food and beverage choices.
- 26% increase in time spent in physical activity.

Family Economic Well Being Impact Teamoffered 572 financial management programs during 2011 with 15,698 participants. Evaluation results indicate:

- 46% of participants intend to make changes to their financial management practices.
- 32% reduced their debt levels
- 17.3% are satisfied with their financial situation

The Family Risk and Resilience Impact Team

Impact evaluation questionnaires submitted by 11 teachers, child care providers, and youth workers with classrooms or groups that received or were utilizing ICPS in 2011 indicated:

- 44-55% rated the overall effect of the program on the children's social and emotional development, the children's behavior, as well as on the classroom/group atmosphere as "somewhat good" or "very positive".
- 71-86% rated children increased the following positive behaviors from prior to the program to after the program: considerate and helpful to others, accepts responsibility for actions, expresses needs and feelings appropriately, thinks before acting, and listens to and understands other people's feelings.
- 71-86% rated children in their classroom increased in the following positive behaviors from prior to the program to after the program: understands consequences of behavior, cooperates and works well with others, and resolves peer problems on their own.

Key Items of Evaluation

In 2011, an Impact Evaluation Questionnaire and In-service Training Evaluation were collected after training or program delivery. Some questions utilized a retrospective pre/post approach.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

4-H Youth Development

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
608	Community Resource Planning and Development	3%		100%	
806	Youth Development	97%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	65.0	0.0	0.0	0.0
Actual Paid Professional	104.0	0.0	0.7	0.0
Actual Volunteer	105.2	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
1903000	0	2951	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1903000	0	2951	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
10400371	0	17088	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

30 - VMS - Recruit, orient and train adult volunteers to serve as club and project club leaders and to

assume leadership on committees who plan and coordinate local and county activity and events.

30 - CMS - Increase the number of 4-H project clubs or project groups within community clubs.

20 - LCD Impact Team - Recruit and train teams of youth and adults, who work in partnership to identify, organize, conduct and evaluate a service learning project which will benefit the community.

27 - EE Impact Team - Provide training and materials for initiating and maintaining teams of youth and adults committed to sharing and promoting environmental education concepts through service learning.

30 - OMK - Train and recruit educators and volunteers to create public awareness of issues affecting military families.

28 - STEM - Provide training and materials for initiating and maintaining teams of youth and adults committed to sharing and promoting STEM concepts through service learning.

30 - All other - Establish, develop, and maintain new and ongoing youth development programming, events, and support materials.

2. Brief description of the target audience

Youth, children, parents, teachers, youth and adult volunteers, middle to low income families; race and ethnicity will also be recognized as an identifier of audiences; caretakers, agencies and service providers, schools, policy makers

3. How was eXtension used?

Within the Companion Animals and STEM areas specialists have served to develop a community of practice and have served as expert reviewers. A new community of practice related to Environmental Education is currently being developed. The eXtension link was added to the Oklahoma 4-H website.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	70000	2500000	627177	16263431

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	8	2	10

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Web-delivered curriculum - lessons developed and tested

Year	Actual
2011	42

Output #2

Output Measure

- Educational trainings offered for volunteers and staff

Year	Actual
2011	46

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Certified participants will manage local programming
2	Caring and qualified adults will prepare youth for successful lives as community leaders and contributing citizens
3	The number of active 4-H project clubs and project groups.
4	Project curriculum in support of Mission Mandates
5	Youth will develop a well rounded understanding of mental and emotional health obtained through project work and activities which encourage healthy life style choices - camping, recreation, shooting sports, fitness, safety, hobbies and creative pursuits through the arts.
6	Youth and adults work in partnership to identify and solve/resolve community needs and environmental issues through an organized and executed plan of action.
7	Youth will learn to make healthy lifestyle choices through the use of curricula and educational materials.
8	Increased number of collaborations with youth organizations
9	Participant teams will Increase knowledge of Oklahoma natural resources and environmental stewardship.
10	Participants in livestock programs will focus on acceptable animal husbandry practices, demonstrating knowledge about animal health, breeding, production, marketing and meat science while being conscientious about product quality assurance, animal welfare/well-being and protection and effects on the environment.
11	Participants will increase knowledge and awareness of STEM technologies and career opportunities.
12	Participants will increase knowledge and awareness of plants and soil systems.
13	Increase knowledge and awareness of entomology.
14	Companion animal programs will focus on animal welfare and human-animal interaction.
15	Military families receiving support through 4-H partnerships will increase their use of local support networks
16	Ag in the Classroom

Outcome #1

1. Outcome Measures

Certified participants will manage local programming

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	6300

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Positive Youth development occurs when volunteers are properly oriented and equipped with appropriate tools to serve as positive role models. Volunteer adults and teens sever as positive role models and mentors and lead 4-H clubs, thus allow 4-H to reach more youth than could be achieved by paid staff alone.
There is a growing body of research showing that youth who feel safe, valued and connected to caring adults are more likely to be positive about life, engaged in school and emotionally healthy; they also are less likely to participate in destructive or delinquent behavior (Ferber et al. 2005). Additionally, in a recent study of Positive Youth Development by Tufts University, 4-H youth that participate in programs that incorporate the Five Cs: Competence, Confidence, Connection, Character, and Caring when compared to other youth were:
Two times more Likely to spend time exercising or being physically active;
Two times less likely to engage in drug use;
Two times less likely to use cigarettes or drink alcohol
Nearly two times more likely to attend college (Lerner et al. R. 2011).
It is almost certain that most 4-H Volunteers and 4-H Educators consider Positive Youth Development as their top priority for 4-H clubs and groups. However, many 4-H Volunteers have not received in depth training on what elements are needed to foster positive youth development or the skills needed to ensure they provide those elements.

What has been done
A team consisting of 4-H county, district, and state faculty came together to coordinate and conduct 3 statewide trainings. These trainings were designed to equip county 4-H educators with tools and methods to prepare volunteers to intentionally develop their 4-H programs with positive youth development as the focus. Before, during and after the training, articles were placed in the Focus on Youth e-newsletter for staff and volunteers on the eight essential elements.

The 4-H Essential Elements curriculum was chosen for the trainings as the National 4-H Impact Design Implementation Team recognized the essential elements as characteristics of an effective program that contribute to positive youth development. Additionally, the four essential elements of belonging, mastery, independence, and generosity tie closely to the Five C's listed in the Tufts study, The Positive Development of Youth.
Trainings consisted of an overview of the Tufts study and the importance of developing programs that intentionally incorporate the elements of positive youth development. Team members shared responsibility in teaching different lessons from the curriculum. Each lesson was taught utilizing hands-on and small group discussions, just as the curriculum was designed to be used with volunteers. In order to expose the educators to as many of the lessons as possible each session was kept short allowing for participation in 6 to 8 activities during each in-service.

Results
After each training, participants completed a Retrospective Pre/Post Evaluation comprised of 29 questions; selected results are listed below.
Evaluation QuestionPre Agreed Post Agreed
I can identify the key ingredients of positive youth development34%95%
I understand and can explain the essential elements to others2%92%
I can discuss the essential elements with ease with volunteers22%94%
I can compare the different ingredients that make a youth program work50%99%
I can demonstrate, through hands-on activities, the importance of Mastery49%99%
I know the opportunity to value and practice service to others is one of the essential elements54% 98%
I know the opportunity to see oneself as an active participant in the future is an essential element of positive youth development63%99%
I can appraise youth development environments to determine if they support positive relationships 63%99%
I can define both community service and service learning57%99%
I can describe the components necessary for a successful service-learning activity to others48% 99%

Additionally, participants were asked how they plan to utilize the Eight Essential Elements in their County Programs; selected responses are listed below.

At quarterly 4-H volunteer meetings and in monthly 4-H newsletter
To show the readers why 4-H is so positive

To get away from PowerPoints in volunteer trainings
Also to plan service learning vs. community service
I like the concept of the pizza pieces. Our volunteers will like these lessons.
By being more specific and intentional about planning my projects
I plan to use them to revamp the club as a whole
Use with volunteers, share with parents, use with judges, teens and advisory councils
Orient my volunteers with the element pizza ingredient workshop to give them a better understanding of positive youth development
I will use this with my teen leaders and county officers
I will teach elements each month and use the activities to reinforce concepts

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Caring and qualified adults will prepare youth for successful lives as community leaders and contributing citizens

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	4705

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth development programs prepare young people to meet the challenges of adolescence and adulthood through a structured, progressive series of activities and experiences. In turn youth develop social, emotional, ethical, physical and cognitive competencies.

What has been done
County, district and state staff recruit, orient, train, utilize and manage adult volunteers who provide leadership to local, county, district and state programming. Extension professionals work in partnership with volunteers to develop the human, social and political capitol of young citizens.

Results
4-HYD addressed the broader developmental assets which all children and youth need - such as caring relationships (475 episodic and certified volunteers); safe places (943 4-H clubs) and activities (1000 4-H events); opportunities for developing good physical and mental health (89164 youth); marketable skills (35,025 youth); and opportunities for service and civic participation (82,534 volunteer hours of service).
The total number of community clubs, one of the venues where the most opportunity for youth to interact with caring adults, increased from 788 community clubs in 2011 to 907 in 2012. Likewise the number of total youth volunteers increased from 693 in 2010 to 1,209 in 2011 and the number of adult volunteers increased from 4,295 in 2010 to 4,454 in 2011.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

The number of active 4-H project clubs and project groups.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	650

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Record book evaluations indicate that fewer 4-H members are doing work in projects for a sustained period of time. As a result they may be experiencing a decline in life skill development. Furthermore, positive youth development research has shown that youth gain the greatest benefit from an experience when there is long-term contact with a caring and significant adult.

What has been done
Training was done in all 4 Extension Districts for staff regarding their own professional development. Educators were asked to evaluate if they were in a service, education, management or leadership role in their careers. They were shown how the use of trained volunteers and project clubs could strengthen their 4-H programs while decreasing their workload over time.

Results
While the actual total number of short-term and special interest groups declined from the previous year there was an increase of nearly 60,000 youth reached in the project club delivery mode. There was also a 7% increase in volunteers in this area.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

Project curriculum in support of Mission Mandates

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	28

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
OCES has a goal of providing current research based information to its program users.

What has been done
4-H training was offered for volunteers, staff, and members related to the Health, STEM and leadership mandates via staff in-services, conferences, and workshops

Results
Over 1000 4-H contacts were made to volunteers, staff and members using new 4-H curricula.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Youth will develop a well rounded understanding of mental and emotional health obtained through project work and activities which encourage healthy life style choices - camping, recreation, shooting sports, fitness, safety, hobbies and creative pursuits through the arts.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	63

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research indicates that youth who spend constructive time out of doors, engaged in physical activity and use their minds for creative pursuits and problem solving demonstrate stronger mental and physical health.

What has been done
Events including: 12 state shooting sports, 27 multi-county camps, State Discovery Unlimited, State 4-H Roundup; reached over 25,000 youth.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #6

1. Outcome Measures

Youth and adults work in partnership to identify and solve/resolve community needs and environmental issues through an organized and executed plan of action.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual

2011	25

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Stakeholders value programs that involve youth and adult partnerships that address real life community needs. Local youth have mapped storm shelters, illegal dumpsites, and established gardens to improved the quality of life for citizens

What has been done
Counties identified needs related to health and wellness, environmental needs, and infrastructures. At least 11 counties created community gardens and farmer?s markets. Over $70,000 in mini-grants were provided to implement local programs.

Results
Educators have indicated an increase in visibility of OCES, members have gained new knowledge and skills in problem solving. Additional examples related to STEM included in Outcome #11

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #7

1. Outcome Measures

Youth will learn to make healthy lifestyle choices through the use of curricula and educational materials.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	9237

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma ranks as the 47th least healthy state with factors such as obesity, smoking, substance use, and risk factors associated with family breakdown. According to the 2007 State of the State

Report, Oklahomans are below average or failing in several indicators of good health. As a State, our citizens tend to not eat enough fruits and vegetables each day. Many citizens are overweight or obese; get little or no physical activity and too many Oklahomans use tobacco. Diabetes, high blood pressure, high blood cholesterol, stroke, heart disease, asthma, lung cancer - these are all negative consequences of the unhealthy lifestyles Oklahomans are living.

What has been done

In 2009 through a Walmart Foundation grant 47 projects were carried out related to Health. One of those was the 4-h Food Showdown which is exploding in popularity. In 2011 the first state contest was conducted in Food and Agriculture Products Center at OSU with 7 qualifying teams competing. Training related to curricula was provided for educators, volunteers and members in: Food Showdown, Health Rocks, Bullying, Fuel-up to Play 60, Farm to You, Kids Cows and More, and Hobbies and Collectables. In late 2011 an additional $55,500 grant was obtained from Walmart to implement 26 new projects and a second round of mini-grants to support county camps is planned in 2012

Results

88% of youth surveyed indicated an increase in knowledge related to healthy decision making related to food choices.
Youth are joining 4-H just to participate in the Food Showdown.

All of the local projects have allowed citizens to learn through workshops demonstrations and hands-on activity the importance of better nutrition and the need for increased fitness. While no scientific analysis has been done and the duration of the grant was not enough to measure long-term impact on health, participants indicate short-term changes in regard to the foods they select, portion sizes, and the amount of physical activity.

Our State 4-H Vice President who has lost over 50 pounds as a result of this grant has shared his success story with countless other youth via Facebook, an interactive display at the World?s Largest Youth Livestock Show, and through speaking engagements as a state officer.

The other teen working on the Kenya project has been able to share her story with international visitors and her video conversation with Kenyan leaders has been on YouTube and Facebook. The long-term impact will make life better for girls have way around the planet from her, but still she sees this as part of making her world community better.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #8

1. Outcome Measures

Increased number of collaborations with youth organizations

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	13

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All youth serving agencies have similar goals to reach as many youth as possible and with decreased resources all must work together to maximize their impact and reach without program duplication.

What has been done
Began working with Red Earth, established 4-H mentoring projects with three tribes and with the Latino agency, a master volunteer conference was conducted in the OKC metro to strengthen volunteers for various youth serving agencies, worked with 5 military installations, Continued to work with FFA, public schools, and YMCA and Scouts.

Results
Over $100,000 in grants were obtained through the dept of juvenile justice for mentoring programs in four sites. New partnerships were established through the volunteer conference efforts.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #9

1. Outcome Measures

Participant teams will Increase knowledge of Oklahoma natural resources and environmental stewardship.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	86

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Participation in competitive events is proven to increase life skills such as decision making and critical thinking while enhancing teamwork and cooperation.

The 4-H Shooting Sports program is designed to assist young people in personal development, the establishment of personal environmental ethics, and the exploration of life-long vocational and avocational activities. The program uses experiential learning and positive interactions with youth and adult role models to help young people develop self-concept, self-assurance and a positive self-image.
The content provides a framework of knowledge and skills for lifetime participation in recreation, hobbies and careers related to shooting sports and wildlife. Core concepts stress safety, ethical development, personal responsibility and life-time recreational skills.

What has been done
Training was provided in Sportfishing, Forestry, Shooting Sports, Wildlife, Range, Water, Homesite and Land judging,
While most of the youth involved in SS would likely not become delinquents, however some may be inclined to become involved in at risk behaviors if not involved in programs that encourage discipline and positive role models. The estimated cost to keep one juvenile delinquent housed in a correctional facility is close to $55,000 per year. In a survey of youth and families in Texas, the estimated cost for a youth to participate in 4-H shooting sports was about $4,320 a year.
Nearly 950 youth competed in one or more state shooting sports contests. Each of these youth had received a minimum of 8 hours of instruction before competing.

Results

Over 50 4-H youth represented Oklahoma at national contests. 46% of the youth who attended the WHEP contest were involved in service learning projects engaging them in their communities. Specific Environmental Impacts in WORD Document??.

Over 6,200 youth are enrolled in the Shooting Sports and they need trained volunteers to instruct them regarding safe use of sporting arms, environmental ethics, and sportsmanship. In 2011, 68 new volunteers were trained and began working with youth in clubs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #10

1. Outcome Measures

Participants in livestock programs will focus on acceptable animal husbandry practices, demonstrating knowledge about animal health, breeding, production, marketing and meat science while being conscientious about product quality assurance, animal welfare/well-being and protection and effects on the environment.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	13000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth need to learn acceptable animal husbandry practices, to demonstrate knowledge about animal health, breeding, production, marketing and meat science while being conscientious about product quality assurance, animal welfare/well-being and protection and effects on the environment.

What has been done
Collaborating with the Oklahoma and National Pork Councils educators continued and expanded the use of the Pork Quality Assurance Plus (PQA Plus) youth education and youth certification program.

Working with OSU Animal Science faculty and students, Ag Educ Teachers, Extension Educators,

and volunteers the ?Big Three? Animal Science Field Day was once again held on the OSU campus. With over 5,000 youth in attendance. Youth not only practiced with live animal evaluation skills, they were able to participate in carcass evaluation workshops, compete in grading contests, and attend educational tours and workshops related to the animal agriculture industry.

Results
Approximately 7000 youth 8-18 years of age in both 4-H and FFA programs were certified in the PQA Plus program as part of their county pork project and enabled them to show at the Oklahoma Youth Expo and the Tulsa State Fair. As a result of this program there has been a decrease in stress related deaths in exhibition animals and a more marketable meat product.

Youth increased their knowledge in live animal evaluation, were introduced to new topics through workshops and encouraged to explore animal science degrees and careers at OSU.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #11

1. Outcome Measures

Participants will increase knowledge and awareness of STEM technologies and career opportunities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	23

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The US is falling dangerously behind other nations in developing its future workforce of scientists, engineers, and technology experts. Only 18% of US high school seniors are proficient in science (NAEP, 2005). Oklahoma 4-H is combating this issue by teaching youth about STEM.

What has been done
Oklahoma?s main vehicle for educating youth about science, technology, engineering, and math has been the 4-H STEM Institute. For 2011, this program was expanded from just geospatial

technologies to include, digital media, robotics, iGreen (Environmental Projects, and Alternative Energy. The STEM Institute was designed to train teams of youth and adult in the use and application of technology. These teams were then charged with the tasks of applying their technology specialty to a community service project or the development of a special project club. Once their project is established or completes the team

Results
Through the Oklahoma STEM Institute 23 County Teams were trained in Digital Media, GPS, Environmental, Alternative Energy, and robotics. The individual team results follow:

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #12

1. Outcome Measures

Participants will increase knowledge and awareness of plants and soil systems.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	12292

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Plants are vital to life on earth. They improve air and water quality, control erosion, provide food and medicine for animals, and have great aesthetic value as well. Children involved in plant science projects increase their agricultural literacy and generally become healthier through physical activity and increased knowledge of healthy eating.

What has been done
The OSU Department of Horticulture and Landscape Architecture and the OSU Department of Plant and Soil Sciences have facilitated plant and soil education for youth in Oklahoma through many activities, productions, and programs. Both departments have sponsored residential academies for youth to experience career-related activities in the plant sciences, hosted judging contests at the state fairs, provided workshops for youth and adults at conferences across the state, and have visited individual classrooms and youth groups throughout the state. Activities in

2011 include:
Presentations about Junior Master Gardener (JMG) ? Oklahoma Environmental Education Expo (OKC Zoo), Payne County Master Gardeners, Ag in the Classroom summer gardening tour, Ag in the Classroom state conference (OKC), retired women?s group
College/Career day presentations ? Stillwater High School Career Day, Stillwater Area Career Fair, Coffeyville Community College, Western OK State College, OSU Student Major Fair, OSU Up-Close, Payne County Career Paths Expo
Educational workshops ? 50-hour Junior Master Gardener day camp at OSU Botanic Garden
Presentations to Youth ? Richmond Elementary (Stillwater, OK), Skyline Elementary (Stillwater, OK), Outdoor Day in Mitch Park with Edmond middle schoolers, Watonga Middle School, Watonga Elementary School, Women in Science conference for Oklahoma female youth (Science Museum Oklahoma)
Productions ? 1 episode for ?Oklahoma Gardening? TV show
Contests ? FFA Career Development Events (floriculture, nursery/landscaping, agronomy), Oklahoma State Fair, Oklahoma/Arkansas State Fair (Ft. Smith, AR), Tulsa State Fair
Residential Camps ?Tomorrow?s Undergraduates Realizing the Future ('Camp TURF' - 2 weeks of career-related activities for 25 first-generation college students from Oklahoma high schools), Plant Science Academy

Results
There was an increase in the number of registered Junior Master Gardener groups over previous years (8 new groups in 2011, 5 new groups in 2010; 1 new group in 2009).

There was an increase in the number of 4H youth participating in the Oklahoma State Fair horticulture judging contest 47 for 2011; 42 in 2010; 38 in 2009).

There was an increase in the number of FFA youth participating in the Floriculture CDE contest (73 in 2011; 64 in 2010; 56 in 2009).

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #13

1. Outcome Measures

Increase knowledge and awareness of entomology.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	300000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Entomology education has a vital impact on agriculture, human and animal health, and preservation of the environment.

What has been done
200 presentations to over 300,000 people allowed the opportunity to observe, study, and directly interact with these animals can have a life-long impact on patrons including: 1) increasing awareness of the vital roles all animals play in the environment and ecological cycles on Earth, 2) breaking down irrational myths and fears commonly held regarding these animals, and 3) fostering a feelings of stewardship, influence, and personal responsibility that will make them better citizens and more caring people.

Results
Each year, many thousands of Oklahomans are educated on the truth and myths surrounding arthropods through the Insect Adventure program.
Participants in the Insect Adventure experience a great reduction in fear regarding the important group of animals called arthropods

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #14

1. Outcome Measures

Companion animal programs will focus on animal welfare and human-animal interaction.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1245

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research studies show that pet ownership can have a positive impact on the quality of life of children by facilitating exercise, teaching responsibility/ compassion and promoting self-esteem.

What has been done
In order to facilitate leadership ideas into the companion animal program the Amazing Small Animal Program (ASAP) teen leader program was developed. This provides a strong base of support and idea sharing as well as providing the youth significant learning experiences and leadership opportunities.
Trainings have been provided to county educators, 4-H volunteers and daycare providers in proper care of pets and utilizing the pets as a tool for teaching children life skill development. Additionally, children have been given opportunity to show their competence at working with their pets at multiple events such as dog shows, pet fun days and rabbit shows.

Results
75 volunteers, 20 educators and 50 day care providers received training on animal-human interactions. 89% of parents polled at the quad-county rabbit show indicated that involvement with small animal projects helped their children become better citizens.
The ASAP Teen Leader Group has representatives from all sides of the state with diverse ideas and experiences to share with each other and the state program. Ideas to inspire other youth and state 4-H programs have resulted in projects such as Humane Shelter Support through the making of toys, treats and blankets, participation in therapy dog programs, pet first aid, heartworm prevention, pet dental health and canine dog bite prevention as well as various ideas for local club meetings.
This group of teens provides new and fresh ideas for the program. This year they planned and conducted the first ever Oklahoma 4-H Pet Fun Day which included educational displays, knowledge bowls, collections for humane shelters, rabbit care workshops and dog training classes. Through this event 4-H ASAP members were able to practice their leadership skills through planning and organizing the event as well as teaching multiple workshops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #15

1. Outcome Measures

Military families receiving support through 4-H partnerships will increase their use of local support networks

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	4453

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Oklahoma National Guard amongst other branches are facing numerous and frequent deployments with 3,500 troops leaving in 2011 having been the largest deployment since the Korean War affecting individuals from all 77 counties. Military service members are deploying by the thousands at Ft. Sill and Tinker AFB annually. Military Kids that are affected by deployment are over looked and often put off as delinquent children, as a reaction to deployment stress in the school system, in rural counties, and urban communities. Raising awareness and keen sense of vigilance to the sensitivity of the issues facing military kids is important as to build a stronger, more focused, fighting military force and resulting in a safer America.

What has been done
A Military Community Support Luncheon program is conducted in pre-selected towns throughout the year to inspire the creation of a local support networks. The creation of two 4-H National Guard Clubs has been made through a close partnership and network with the Oklahoma National Guard. Five Camping opportunities were provided to military kids and their family to help cope with the stresses of deployment and reintegration upon returning. A Speak Out Military Kids camp was conducted to empower military teens to express their stories and raise awareness of the issues facing military kids. Nineteen RSG trainings and seven informational briefings were conducted to educate the Oklahoma communities and develop vigilance and understanding to develop support during the deployment cycle. A fund raising initiative with Frontier City and White Water Bay resulted in $350 to the 4-H Foundation to be used for military kid support. Presentations were conducted to 4-H youth while preparing and fostering connection to military kids through the Hero Pack project.

Results
During 2011 the 4-H military partnership and the OMK initiative has reached 2,416 children and from the 4-H club grant allowed the opportunity to reach an aggregated total of 391 military

children. Currently, there is a 4-H club on each activity duty installation to include McAlester Ammunition Depot, Fort Sill Army Post, Tinker Air Force Base, Vance Air Force Base, and Altus Air Force Base. Plus the first 4-H club to be installed on the Tulsa Oklahoma Air National Guard Base 138th Fighter Wing with 34 members and the first 4-H club to be established with the Oklahoma Army National Guard Youth Teen Panel with 12 members. A total of 1407 Hero Packs were assembled and distributed. All totaled youth focused programs were conducted reaching a total of 4,453 military related individuals.
Other Agencies involved as local partners with OMK: American Legion, State Dept of Education, Boys and Girls Clubs, Army National Guard, Active Day Army Garrison Staff, Army Reserve, Navy Reserve, Air Force Reserve, Oklahoma National Guard

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #16

1. Outcome Measures

Ag in the Classroom

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	4000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With fewer families directly involved in production agriculture there is a need to help citizens gain an appreciation of the economic, social, historical, and scientific importance of agriculture in our society.

What has been done
In an effort to help participants recognize the connection between agricultural production and the daily consumption of food and fiber products, to explore the many career opportunities in all areas of agriculture, and generally increase agricultural knowledge, OCES supported the Ag in the Classroom program through curriculum development and a website.

Results

A USDA grant was obtained for nearly $50,000 to assist with teacher training and curriculum support. 500 teachers participated in a state Ag in the Classroom Conference and 50 teachers participated in an educational tour where they had hands-on educational experiences related to agriculture. Three new lessons were developed related to tour stops, and career information was presented at each place to help teachers make their students aware of career possibilities in agriculture.

A website with educational resources including lessons for grades K-8 was maintained with an average over 3000 hits per month. Social media was also introduced as a way to communicate with teachers, with 1070 followers on the OAITC page.

A monthly e-newsletter goes out to 4,000 subscribers to share timely teaching ideas, with resources and links to lessons.

Currently an on-line survey is being conducted among users of the program. Of the respondents, 48% report using the site and lessons 1-2 times per month and 22% more indicate using lessons 1-2 times per semester.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Competing Programmatic Challenges

State 4-H Staff spent about 12 hours per week planning for new FCS and 4-H Issue Teams. This time was often added on top of other planned programming but in some cases did compete for time that might have otherwise been spent on program evolutions

Populations changes (immigration, new cultural groupings, etc.)

In 2010 4-H established a new Latino 4-H club in OKC but due to grant requirements the efforts of that program were redirected more to serving military families in 2011. Since that time three new 4-H Mentoring programs have been implemented while the bulk of this work is new and will be reported in the 2012 PY one of the sites has already gotten underway and has enrolled 67 tribal youth, primarily of Choctaw, Cherokee, and Creek

descent.

Also, in 2011 Oklahoma 4-H implemented a new 4-H enrollment system called ACCESS 4-H. While the new system will in time improve the accuracy of 4-H enrollment data it is anticipated that there will fluctuations over the first couple of years due to enrollment corrections and adoption of a new reporting system.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

There was not a statewide 4-H evaluation done in 2011 however several program evaluations were done as reported for various outcomes. Currently with new issues teams several tools are being tested for future use by field staff to consider the impact of 4-H. Efforts are also underway for Oklahoma 4-H to be part of the 2012 Gallup School Poll so we can see how Oklahoma 4-H youth compare to their School peers within the state as well as nationally.

Trainings consisted of an overview of the Tufts study and the importance of developing programs that intentionally incorporate the elements of positive youth development. Team members shared responsibility in teaching different lessons from the curriculum. Each lesson was taught utilizing hands-on and small group discussions, just as the curriculum was designed to be used with volunteers. In order to expose the educators to as many of the lessons as possible each session was kept short allowing for participation in 6 to 8 activities during each in-service.

After each training, participants completed a Retrospective Pre/Post Evaluation comprised of 29 questions; selected results are listed below.

Evaluation Question
Pre Agreed
Post Agreed

I can identify the key ingredients of positive youth development
34%
95%

I understand and can explain the essential elements to others
2%
92%

I can discuss the essential elements with ease with volunteers
22%
94%

I can compare the different ingredients that make a youth program work
50%
99%

I can demonstrate, through hands-on activities, the importance of Mastery
49%
99%

I know the opportunity to value and practice service to others is one of the essential

elements
54%
98%

I know the opportunity to see oneself as an active participant in the future is an essential element of positive youth development
63%
99%

I can appraise youth development environments to determine if they support positive relationships
63%
99%

I can define both community service and service learning
57%
99%

I can describe the components necessary for a successful service-learning activity to others
48%
99%

Additionally, participants were asked how they plan to utilize the Eight Essential Elements in their County Programs; selected responses are listed below.

- At quarterly 4-H volunteer meetings and in monthly 4-H newsletter
- To show the readers why 4-H is so positive
- To get away from PowerPoints in volunteer trainings
- Also to plan service learning vs. community service
- I like the concept of the pizza pieces. Our volunteers will like these lessons.
- By being more specific and intentional about planning my projects
- I plan to use them to revamp the club as a whole
- Use with volunteers, share with parents, use with judges, teens and advisory councils
- Orient my volunteers with the element pizza ingredient workshop to give them a better understanding of positive youth development
- I will use this with my teen leaders and county officers
- I will teach elements each month and use the activities to reinforce concepts

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Turfgrass Development and Management

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	6%		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	57%		15%	
206	Basic Plant Biology	0%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	2%		10%	
212	Pathogens and Nematodes Affecting Plants	5%		10%	
216	Integrated Pest Management Systems	15%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	1.6	0.0	2.0	0.0
Actual Paid Professional	2.0	0.0	2.0	0.0
Actual Volunteer	0.1	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**
36000	0	102149	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
36000	0	102149	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
270000	0	563916	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Commercially available and experimental turfgrasses across 12 species were evaluated by various members of the Turfgrass Team. New turf bermudagrass cultivars were generated, commercialized and licensed. Previously generated dollarspot prediction models were tested across 5 states. Research identified new or refined integrated management practices. Educational materials were developed concerning improved management practices and disseminated to industry through 22 workshops and several e-newsletters and several thousand consultations. Rational decision making based on the combination of science, perception and sound public policy will be made by the turf industry and the public at large. Resultant adoption of integrated turfgrass management strategies will occur and turfgrass performance can be maintained or improved with reduced potential negative environmental impacts.

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/lawncare 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

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	39457	29749	90	500

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

Patent Applications Submitted

Year: 2011

Actual: 2

Patents listed

PVP for turf grass varieties.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	8	8	16

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of peer-reviewed journal articles manuscripts submitted

Year	Actual
2011	8

Output #2

Output Measure

- Number of final stage experimental bermudagrasses sent to national testing phase in the NTEP bermudagrass trial

Year	Actual
2011	0

Output #3

Output Measure

- Number of turf/roadside vegetaion management workshops conducted

Year	Actual
2011	24

Output #4

Output Measure

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

Year	Actual
2011	962

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	Multi-state Evaluation of Creeping Bentgrass Cultivars for Resistance/Tolerance to Dollarspot Disease Under Putting Green Conditions
5	Improving the Control of Diseases Affecting Perennial Horticulture Commodities in Oklahoma
6	Evaluation of Newer Drift Control Adjuvants for Herbicide Tank-Mix Compatibility

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
2011	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The ability to survive harsh winters is one of the primary factors limiting bermudagrass (Cynodon sp.) use across wide geographic areas. Consequently, improved stress tolerance has been a goal for programs breeding bermudagrasses.

What has been done
Research and develop at Oklahoma State University during the last 11 years resulted in the breeding, initial selection, testing in the 2007-2012 National Turfgrass Evaluation Program bermudagrass trial, commercial release, submission for plant patent and licensing of OKC1119 and OKC1134 bermudagrasses. These two varieties have improved color, texture, density, cold hardiness, and injury recovery rates. These two products were licensed to Sod Solutions, Inc. during 2011. The two varieties were trade marked by Sod Solutions as Latitude 36 (OKC1119) and NorthBridge (OKC1134). In a cooperate effort with OSU, Sod Solutions has sublicensed 6 producers of each of these varies in 2011. One of the sublicensees was located in Oklahoma. The first sod of the two products will begin to be available for commercial purchase by consumers from a Maryland producer in spring 2012 and may be available from the Oklahoma producer in fall of 2012.

Results
Latitude 36 (OKC1119) and NorthBridge (OKC1134) hybrid bermudagrasses were licensed to Sod Solutions, Inc. Sod Solutions, Inc., in cooperation with OSU, located and sublicensed six (6) sod producers in the US to produce the two new varieties. Foundation sprigs of the two new bermudagrass were planted in pedigree stock production and area being produced by the growers.

Latitude 36 (OKC1119) and NorthBridge (OKC1134) hybrid bermudagrasses when purchased

and installed by end users will be less likely to sustain winterkill than Tifway in areas that frequently experience low winter temperatures. These two new varieties have a faster recovery rate from traffic on intensively used athletic fields resulting in safer playing conditions that using variety not specified or older bermudagrass varieties.

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

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A number of serious diseases attack bentgrass putting greens across the US and world. One of these diseases is dollarspot fungal disease. Fungicides are very expensive and they posse off target environmental risk. A basic IPM strategy against dollarspot is the identification of bentgrass cultivars with improved dollarspost disease resistance.

What has been done
A three year multi-state putting green bentgrass project continued to identify varieties that had resistance to dollarspot fungal disease. Resistance information was transferred to golf course superintendents at a summer pest management field day in 2011.

Results

Several commercially available cultivars were identified with improved dollarspot resistance/tolerance. Cultivar information was conveyed to Eighty percent of those superintendents receiving the dollarspot information at the field day in 2011 stated they will switch to newer, more resistant varieties as windows of opportunity for renovation of putting greens arises over time.

Installation of bentgrass cultivars with increased dollarspot disease resistance/tolerance will result in less incidence of the disease. This will lead to reduce unnecessary fungicide applications and improved golf playing conditions. By reducing fungicide applications turfgrass managers can save money (hundreds of dollars per acre per application) and reduce the negative environmental and human effects that often coincide with pesticide use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

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
2011	960

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New integrated turfgrass management practices can include development of disease resistant or stress tolerant varieties, elucidation of techniques that allow for improved pest control with equal or less pesticide applications.

What has been done

A 2-day intensive turfgrass short course, a one-half day turfgrass field day, a two day general turfgrass conference, 3 sprayer calibration workshops and 14 roadside vegetation management continuing education workshops were conducted to teach Best Management Practices in fine and roadside turfgrass in 2011. Over 960 attendees were present at these workshops.

Results
Eighty-five percent of fine turf managers trained and 100% of roadside vegetation managers trained stated that they would be adopting the suggested Best Management Practices provided in the training sessions. Ninety percent of conference attendees said they would consider attending the fall 2011 conference. Ninety percent of attendees felt education at the short course left them with knowledge such that they could better management their facility. Eighty-five percent of attendees felt the knowledge gained would help them manage turf in a more environmentally conscience manner. Eighty percent of attendees felt that increased knowledge would allow them to save their employers money in the future. Ninety percent of attendees felt that knowledge gained from the short course would allow them to maintain higher quality turf.

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

Multi-state Evaluation of Creeping Bentgrass Cultivars for Resistance/Tolerance to Dollarspot Disease Under Putting Green Conditions

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A number of serious diseases attack bentgrass putting greens across the US and world. One of these diseases is dollarspot fungal disease. Fungicides are very expensive and they posse off target environmental risk. A basic IPM strategy against dollarspot is the identification of bentgrass cultivars with improved dollarspost disease resistance.

What has been done
A three year multi-state putting green bentgrass project continued to identify varieties that had resistance to dollarspot fungal disease. Resistance information was transferred to golf course superintendents at a summer pest management field day in 2011.

Results
Several commercially available cultivars were identified with improved dollarspot resistance/tolerance. Cultivar information was conveyed to Eighty percent of those superintendents receiving the dollarspot information at the field day in 2011 stated they will switch to newer, more resistant varieties as windows of opportunity for renovation of putting greens arises over time.

Installation of bentgrass cultivars with increased dollarspot disease resistance/tolerance will result in less incidence of the disease. This will lead to reduce unnecessary fungicide applications and improved golf playing conditions. By reducing fungicide applications turfgrass managers can save money (hundreds of dollars per acre per application) and reduce the negative environmental and human effects that often coincide with pesticide use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

Improving the Control of Diseases Affecting Perennial Horticulture Commodities in Oklahoma

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A number of serious diseases attack bentgrass putting greens across the US and world. Fungicides are very expensive and they posse off target environmental risk. A reliable method of prediction of the need for fungicide applications is needed to both control putting green diseases and reduce the number of unnecessary applications.

What has been done
To improve management recommendations and promote wise-use of fungicides, researchers developed weather-dependent predictive algorithms using risk indices and linear regression techniques to predict infection periods for several bentgrass putting green pathogens. Independent validation studies (studies not used in the model building process) were conducted in 2009 and 2010. As a result of these research experiments, funding was obtained from the United States Golf Association to validate the model in five locations throughout the U.S. (Oklahoma, Wisconsin, Mississippi, Tennessee, and Pennsylvania) in 2011.

Results
Fungicide protection was predicted during all periods when significant dollar spot events were recorded. If these had been actual trials rather than dramatizations, the advisory would have resulted in a significant savings in the number of fungicide sprays in both locations as compared to a traditional, calendar-based 14-day spray program. In Oklahoma alone, three and six fungicide sprays could have been saved over the 2009 and 2010 growing seasons, respectively. Results from the 2011 trials across five states indicate that an average of one fungicide spray was saved across all locations without compromising disease control.

Successful results in preliminary modeling allowed researchers success in obtaining USGA funding for a two-year study to validate the model in diverse locations around the country including Oklahoma, Mississippi, Pennsylvania, California, Wisconsin, and Tennessee. 2011 results showed a savings of one fungicide application at each location. This can result in several thousands of dollars in savings per fungicide spray. This research will result in the development of a new and improved disease advisory for recommending fungicide applications for dollar spot management. This advisory will be much more accurate than previous advisories because it uses regression-based models and temperature and relative humidity as inputs rather than rainfall. The improved accuracy, ability to use the advisory throughout the United States, and speed at which a recommendation can be obtained from the system will result in more timely applications of fungicide and reduce unnecessary fungicide applications. This will improve the control of dollar spot, which translates to improved golf playing conditions, and will reduce the amount of unnecessary fungicide applications. By reducing fungicide applications turfgrass managers can save money (hundreds of dollars per acre per application) and reduce the negative environmental and human effects that often coincide with pesticide use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

Evaluation of Newer Drift Control Adjuvants for Herbicide Tank-Mix Compatibility

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Drift control additives are useful in reducing herbicide particle drift. The Oklahoma Department of Transportation uses drift control additives in every tank of herbicides used in broadcast weed control applications to Oklahoma roadside rights-of-way. Detain II, a drift control additive used by the ODOT, was being phased out. Additionally, this product had a short shelf life of only 6 months. Corral Poly and Control brand drift control additives have a shelf life of more than 1 year. Drift control additives are essentially not regulated and they need to be screened for tank-mix compatibility before being used on a large scale.

What has been done
The OSU Roadside Vegetation Management team screened Corral Poly and Control brand drift control additives for tank-mix compatibility with 15 herbicide tank mixes commonly used by the ODOT. An industry standard jar test was utilized.

Results
The Control brand product was found to be compatible with all 15 tank mix herbicides. The Corral Poly adjuvant was compatible with 14 of the 15 tank mix herbicide combinations. However, it had moderate to severe physical incompatibility with prodiamine 65WDG. This was evidenced by moderate to severe flocculation followed by settling and eventually the formulation of a heavy mass of large flocculated particles. Control and Corral Poly were added to the ODOT Approved

Herbicide and Adjuvant List.

The Control brand product can be used with any of the 15 commonly used herbicide tank mixes utilized by ODOT for roadside weed control with Corral Poly being suitable with 14 of the 15 mixes. ODOT will experience longer shelf life for either of these two drift control additives as opposed to the old Detain II product, which may be discontinued shortly. Additionally, ODOT will experience about a $0.33 per acre savings in switching to one or both of the newly tested products. This should result in approximately a $33,000 savings per year in reduced drift control additive costs (based on 100,000 acres of OK state roadsides treated annually) with increased product carry-over shelf life and no loss of drift control efficacy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

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 to extreme drought was present over most of Oklahoma in 2011. Renovations to golf courses and properties were nearly non-existent to very conservative since water resources were limited in 2011. Sod sales from sod farms were modest based on reduced new housing starts, no new golf course construction, limited highway construction and extreme water use rates due to record temperatures and drought. Substantial turfgrass loss occurred on golf courses and lawns in southwest Oklahoma when irrigation was not practiced or when access to irrigation water was curtailed during the drought. Replacement of lost turf, especially in western Oklahoma, did not occur and will not be undertaken until the extended drought ends. In most areas of central and eastern Oklahoma, drought damaged warm-season turfgrasses will self repair over time once suitable rainfall and good management is practiced.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The 2- day Oklahoma-Arkansas Turfgrass Shortcourse now represents the educational event with the most thorough post-event attendee survey. In a post-short

course survey of spring 2011 workshop attendees, 95% of conference attendees said they would consider attending the fall 2011 conference. Ninety percent of attendees felt education at the short course left them with knowledge such that they could better management their facility. Eighty-five percent of attendees felt the knowledge gained would help them manage turf in a more environmentally conscience manner. Eighty percent of attendees felt that increased knowledge would allow them to save their employers money in the future. Ninety percent of attendees felt that knowledge gained from the short course would allow them to maintain higher quality turf.

Key Items of Evaluation

Continuous Adoption of Best Management Practices for Turfgrass Management results in the most cost effective and suitable way to manage turfgrasses for suitable performance

Each year a turfgrass management short course, field day and state-wide continuing education conference as well as several e-newsletters are sent to the professional Oklahoma turfgrass management industry. Additionally, 20 roadside vegetation management training events are held under contract for ODOT employees. Post turfgrass short course education session survey of attendees intent to adopt or continue to use complicated arrays of new Best Management Practices presented during the 2-day short course and conference are generally surveyed. ODOT employees are required by policy to adopt the practices presented by the OSU extension personnel upon consultation with field division supervisors. Perception of attendees concerning whether or not the adoption of the most recent BMPs led to a net savings in overall management costs for their employers, whether the information presented at the workshop will help the employee better manage turfgrass problems, whether or not employment of the information presented will results in a higher quality turfgrass area, was assessed post-presentation.

Ninety-five percent of conference attendees said they would consider attending the fall 2011 conference. Ninety percent of attendees felt education at the short course left them with knowledge such that they could better management their facility. Eighty-five percent of attendees felt the knowledge gained would help them manage turf in a more environmentally conscience manner. Eighty percent of attendees felt that increased knowledge would allow them to save their employers money in the future. Ninety percent of attendees felt that knowledge gained from the short course would allow them to maintain higher quality turf.

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Community Resource and Economic Development

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
608	Community Resource Planning and Development	100%		100%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	11.0	0.0	1.0	0.0
Actual Paid Professional	14.0	0.0	4.0	0.0
Actual Volunteer	5.8	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
250000	0	188822	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
250000	0	188822	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
1500000	0	1042390	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Strategic planning training and strategic planning for communiites, infrastructure planning, community service plans, medical facilities and services planning, training of county elected officials, engineering and manufacturing consulting, community economic development studies, community leadership and agricultural leadership development, and entreprenuership training and development.

2. Brief description of the target audience

The target audience includes community leaders (volunteer and elected), agricultural leadership participants and alums, and business owners/prospective owners, hospitals, schools, chambers of commerce, other agencies

3. How was eXtension used?

Most of our programs had very limited use of eXtension. E-commerce modules from eXtension are used when relevant, as are ideas on entrepreneurship programming.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	35065	2086655	1500	200

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	5	5	10

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of community services plans completed

Year	Actual
2011	67

Output #2

Output Measure

- Number of education modules completed

Year	Actual
2011	1

Output #3

Output Measure

- Number of county officer training courses conducted

Year	Actual
2011	59

Output #4

Output Measure

- Number of manufacturing firms receiving applications engineering assistance

Year	Actual
2011	126

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number improving business skills
2	Number of manufacturing jobs created or retained
3	Number of communities where capacity was increased
4	Number of participants that plan to open/expand a business
5	Number of communities that build plans for growth and/or improvement
6	Number of leadership class graduates actively participating in community or industry

Outcome #1

1. Outcome Measures

Number improving business skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	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
608	Community Resource Planning and Development

Outcome #2

1. Outcome Measures

Number of manufacturing jobs created or retained

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	198

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Of the over 5000 manufacturers in Oklahoma, approximately half are located in rural areas and are extremely important to their local economies. The loss or downsizing of even one of these wealth-generating small or mid-sized companies can have devastating consequences for the host and surrounding communities. These rural firms face particular difficulty in getting relevant and usable information and technical assistance that will keep them abreast of the rapid changes in manufacturing technology.

What has been done
To address the difficulties faced by our small rural manufacturers, the College of Engineering, Architecture and Technology and the Division of Agricultural Sciences and Natural Resources at Oklahoma State University work in partnership to provide technical assistance through the Applications Engineering program. Since 1997, Applications Engineers have been deployed in the state in collaboration with the Oklahoma Cooperative Extension Service and the Oklahoma Manufacturing Alliance to provide on-site engineering assistance.

Results
In 2011, the Applications Engineers client projects resulted in increased sales of more than $18.4M, while retaining an additional $15.0M in sales that would have otherwise been lost. Further, the expertise provided by our engineers created cost savings of $4.4M, and avoided additional costs estimated at $3.1M. With 110 new jobs created and 68 jobs retained, our projects provided an additional $13.4M to the state's economy. Finally, we invested over $10.8M in new plant facilities and equipment, for a total economic impact of $65.3M.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #3

1. Outcome Measures

Number of communities where capacity was increased

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	123

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
State and Federal rules, regulations and laws change often and county elected officials and their staffs turnover regularly. Thus there is a constant need to educate new officials with respect to the laws and procedures and to update and provide new methods for existing officials.

What has been done
One of the activities contributing to this Planned Program is the County Training Program. Oklahoma Cooperative Extension provides an array of training and educaitonal sessions for incumbant and new elected county officials through the OCES County Training Program. These sessions are designed to help county government officials to improve efficiency and comply with state and federal law.

Results
More than half of participants in certification classes in the January - June 2011 timeframe said they not only 'learned' something useful, but 'put into practice' something they learned at the training session. The County Training Program conducted thirty-four short-courses during this timeframe. Although county officers and deputies immediately indicate on post-course evaluations that the programs are good and appreciated, the question is "Are these county officials benefiting from and applying lessons learned when they return to their office?" All participants were surveyed. Each person had the option to respond by mail or via a website. All responses were anonymous. The following is a summary of the responses to each question:

1)Ninety-three percent of respondents described the course as excellent or good.
2)Ninety-four percent judged the class to be worth the time, effort, and expense.
3)Ninety-four percent said they learned some or several things they could take back to the office and put to use.
4)Fifty-eight percent said that they did put one or more things into use back at the office.
5)Examples of what they did are numerous. Some of these are easily understood and others are not. All responses show impact. An exact quantitative or qualitative measure would be difficult to determine.
6)Eighty-five percent said they learned worthwhile information even if they did not put it into use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #4

1. Outcome Measures

Number of participants that plan to open/expand a business

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	109

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
E-commerce - Small businesses in rural areas tend to struggle to establish a market presence and compete in today?s economy.

What has been done
During 2011, the Oklahoma State University e-commerce program provided training to over 230 small businesses on how to plan, effectively set up, and promote their websites, which can help address these issues. Of the 2011 participants, ratings for all relevant e-commerce workshops were quite high. Our most popular workshop changed this year. As more small business owners are becoming familiar with setting up a website, their focus has turned to Search Engine Optimization (SEO), or getting their website found on the web. We conducted 13 workshops on SEO during 2011 to a total of 154 participants.

Results
Response to the SEO workshops has been incredible. About ¾ of all participants had a website before this workshop. After the training, 95% of respondents planned on increasing their web efforts, and 93% indicated that they would be changing the way they marketed their website. We also offered 6 workshops more geared to those business owners without websites, and our 'Websites 101' class was attended by 53 different people. These half-day, hands-on sessions are positively impacting rural businesses as evidenced by success stories of former attendees. These include those who used simple template-based software programs used in the workshops to set up their own websites (such as the drive-in in Lawton - www.waynesdriveinn.com), incorporated new techniques such as Facebook ads to draw traffic to their site (such as the

jewelry saleswoman in Shawnee - visit Designs By Robbie Girl on Facebook), or made successful changes to their own site (such as the lodge owner in Idabel who learned several techniques to attract more visitors - www.blackbearcabinok.com). Further, anecdotal evidence suggests that the improved advertising offered by a website can increase small business sales anywhere from 20% to over 200%. With average sales of $150,000 (which was the average displayed in a small business report by Mississippi State in 2007) this implies that the e-commerce program increased the revenue of small businesses in Oklahoma by between $7.1M and $71.0M during 2011.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #5

1. Outcome Measures

Number of communities that build plans for growth and/or improvement

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Retail Trade and Economic Analysis

What has been done
Capacity was increased in 21 communities by providing them with information about their retail trade activity and local economy generally. Given that retail sales tax collections are a significant funding mechanism for municipalities in Oklahoma, these reports provide communities with critical information for monitoring and evaluating local retail activity; these reports are also useful for identifying new retail opportunities for local communities ? useful for economic development programming.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #6

1. Outcome Measures

Number of leadership class graduates actively participating in community or industry

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	64

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Leadership Wagoner County - Faced with significant growth in the region, with the presence of an unique and special natural resource in Lake Fort Gibson for recreation and quality of life, and a strong sense or personal and community identity in the communities of Wagoner and Coweta as well as the rural areas, committed community leaders of Wagoner County need to learn processes and develop strategies to positively embrace 'the community' on a larger scale than their town or city. This program introduces and uses a collaborative leadership process to directly address important issues.

What has been done
We provide monthly training for a class of 25-30 participants. Our training focus is three-fold: leadership skill development, public policy process engagement, and relevant issues awareness. We strive to not only develop better leaders, but also inspire potential leaders to serve in those roles for their communities and their business. Racial, gender, age, geographic, educational and professional diversity has always been encouraged in the class-selection process. Training focuses on three major areas: leadership skill development (i.e., public speaking, conflict resolution, etc.), public policy process involvement (local, state and federal government). Training is accomplished through a series of monthly workshops from August through April over a one-year period, for a total of about 72 hours of training. Training sessions are held in a variety of locations around Wagoner County.

Results

Of the 102 alumni to date, over 90 percent are involved in hundreds of local, state, and national and community organizations. Over half serve on various boards of directors, and over several are in elected or appointed public positions, including the local chamber of commerce, school boards, city councils and county government.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Competing Public priorities
- Other (Budget reductions)

Brief Explanation

The poor economy has caused many individuals to start a business or turn to home-based business options.

Annual appropriation for the CTP in FY 09 was $400,000. Appropriations were reduced to $372,000 for FY '10 and reduced to $330,000 for FY '11. These reductions are reducing programs, travel, publications, hence, outcomes and impact.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Program: Applications Engineering / Manufacturing Consulting - In order to receive engineering assistance the client must agree to a post-project impact assessment. This impact assessment is done using procedures developed by the National Institute for Standards and Technology for the Manufacturing Extension Partnership. The client is contacted some months after the completion of an activity and is asked a series of questions designed to assess the impact of the effort.

The impact of this program is measured in several ways. One is the economic value of the service to the company as reported by the client. Another measure is the number of jobs created or retained. Both impacts are measured by an independent survey of the client. Number of jobs created or retained is translated into economic impact using an income multiplier to compute the direct, indirect, and induced effects due to a change in

the number of jobs in the manufacturing sector.

The multiplier was developed from data collected from two different sources. First, the average salary for manufacturing in Oklahoma ($34,323) was taken from the U.S. Bureau of Labor Statistics published information for 2001. Secondly, the income multiplier of 2.2 was obtained from IMPLAN data for Oklahoma. The total economic impact can be computed by multiplying the average annual salary times the income multiplier to arrive at $75,511 for each new or retained job in the manufacturing sector.

Program - E-Commerce. Surveys delivered immediately after each workshop validate the content and also provided input for related topics of interest for rural businesses. Evaluation results have been very positive for all "Website 101," "Introduction to PayPal," and "Getting Your Business Found on the Internet" workshops. Further, we held additional workshops in 2011 for businesses considering using online storefronts such as Amazon.com or Etsy.com. Results indicated that these were well received, and will likely be repeated in other parts of the state. Future workshops will continue to include suggestions from previous surveys and will seek to address hot e-commerce topics, such as Google advertising, Facebook advertising, and Web 2.0 techniques

Key Items of Evaluation

In 2011, the Applications Engineers client projects resulted in increased sales of more than $18.4M, while retaining an additional $15.0M in sales that would have otherwise been lost. Further, the expertise provided by our engineers created cost savings of $4.4M, and avoided additional costs estimated at $3.1M. With 110 new jobs created and 68 jobs retained, our projects provided an additional $13.4M to the state's economy. Finally, we invested over $10.8M in new plant facilities and equipment, for a total economic impact of $65.3M.

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

Global Food Security and Hunger - Integrated Pest Management

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation	10%		10%	
202	Plant Genetic Resources	2%		5%	
205	Plant Management Systems	10%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	15%		20%	
212	Pathogens and Nematodes Affecting Plants	5%		20%	
213	Weeds Affecting Plants	10%		5%	
215	Biological Control of Pests Affecting Plants	8%		5%	
216	Integrated Pest Management Systems	35%		20%	
601	Economics of Agricultural Production and Farm Management	4%		5%	
901	Program and Project Design, and Statistics	1%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	2.0	0.0
Actual Paid Professional	4.0	0.0	6.0	0.0
Actual Volunteer	4.9	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**
100000	0	284780	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
100000	0	284780	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
440000	0	1572129	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Assessment of stakeholder priorities for IPM
Conduct targeted research on pest status, suppression and IPM approaches
Develop and deliver IPM programs to stakeholders
Develop pesticide applicator education and pesticide information
Assess impact of educational activities on stakeholder IPM

2. Brief description of the target audience

Agricultural Producers, Agricultural Groups, Commercial Growers, Retailers, Agricultural Professionals (private, commercial and non-commercial), and landowners, nurseries, individual stakeholders.

3. How was eXtension used?

IPM coordinator participated in School IPM eXtension community of practice, attended 6 teleconferences.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2331	53890	330	800

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

Patent Applications Submitted

Year: 2011
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	39	14	53

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Stakeholder assessment

Year	Actual
2011	1

Output #2

Output Measure

- IPM schools, conferences and workshops
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Pesticide applicator education schools and workshops

Year	Actual
2011	10

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Peer reviewed research publications and extension publications

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	53

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma State entomologists saved Oklahoma wheat growers more than 1.5 million in yield losses by screening winter wheat varieties for resistance to Hessian fly, resulting in the release of 5 new wheat varieties that contained partial or full resistance to Hessian fly. Research is continuing to monitor emergence patterns for Hessian fly for development of pest management strategies.

What has been done
Winter wheat is grown on 5.6 million acres in Oklahoma for pasture, grain and dual purpose (pasture + grain). Hessian fly has become a more prominent pest due to fly-susceptible varieties. Traditional ?fly free? planting dates that were developed in the 1030?s appear to be ineffective.

Results
Estimates of yield loss suffered by Hessian fly infestations can reach 5 bushels per acre, when a susceptible variety is infested with 1 fly per stem. A Hessian fly screening program (lab and field) was instituted to evaluate new winter wheat releases through the Oklahoma State winter wheat breeding program. Two resistant varieties of winter wheat ?Duster? and ?Centerfield? were released in 2006. Duster has been rapidly adopted by Oklahoma wheat growers, going from 0.3% of acres planted in 2008 to more than 16% of acres planted in 2011, and becoming the 2nd most planted variety in Oklahoma. Additional varieties, ?Billings? which was released in 2009, ?Ruby Lee? released in 2011, and ?Gallagher? which was released in 2012, are also partially or fully resistant to Hessian fly. In addition, entomologists are using a newly developed pheromone to monitor seasonal emergence of Hessian fly for development/enhancement of management tools for Hessian fly.

Approximately 848,000 acres of the winter wheat acres were planted to ?Duster?. Of that, a

minimum of 5% or 50,000 acres were planted in areas where Hessian fly was documented to be a serious problem in the 2 years previous to 2011 resulting in an estimated $1,500,000 in yield savings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #2

1. Outcome Measures

Increased use of pest management approaches for targeted cropping system acres

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	185000

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 125,000 acres in 2010-2011 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.

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.

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 2010-2011 canola crop.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

Number of trained certified pesticide applicators

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	600

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Structural pests are usually unwanted and uninvited house guests, except at the newly constructed facility for structural and urban pest control. Subterranean termites do in excess of 2 billion dollars of property damage each year in the United States. Homeowners spend over $1 billion annually in treatments for termite control. Figures from the National Pest Management Association indicate that the annual billing for general pest control in private dwellings, commercial restaurants, hotels, motels and commercial food outlets is $6 billion.

What has been done
The Oklahoma State Pesticide Safety Education Program offers educational programs targeted at pesticide applicators that includes content on using IPM approaches for managing pests and applying pesticides in a responsible, safe and legal manner. Programs include specific workshops related to pesticide application and Extension programs that offer Continuing Education Units (CES?s) in various certification categories that allow certified applicators to continually improve their knowledge of IPM and safe use of pesticides. The Pinkston Education Facility (PEF) provides students access to many different construction examples and treatment problems. One goal of PEF is to have the majority of applicators in Oklahoma attend a workshop at the facility either as a new applicator in the 2 day class or in a one day refresher class.

Results
Presently, as of December 2011, (600) applicators participated in the structural practical at the Pinkston Educational Facility and 701 applicators completed the practical for General Pest Control certification. The applicators are from Oklahoma, Kansas, Missouri, Arkansas, Colorado, New Mexico, Arizona and Texas. Also completing the courses were 27 ODAFF inspectors, 6 graduate students and 4 OSU staff. The school is designed to assist applicators in learning or refreshing skills needed in treating structures for termites, general pests and pests found in food processing areas. Some of the comments from class attendees have been: "I'm impressed with the amount of material covered during the class", "I've been doing termite work for 12 years and never did it that way", "I had no idea tip selection made that much difference", "I just realized that I need to charge more".

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
901	Program and Project Design, and Statistics

Outcome #4

1. Outcome Measures

Increase in percent of growers with knowledge of and adoption of Glance n Go aphid sampling procedure in wheat

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	10

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wheat is grown on more than 19,000,000 acres each year in Colorado, Kansas, Nebraska, Oklahoma and Texas. Cereal aphids are a key pest of winter wheat in Oklahoma, and the greenbug is the most important of those aphid pests. Annual losses from greenbug vary from $500,000 to $130 million.

What has been done
OSU researchers and extension educators developed a sampling system, called "Glance n' Go" that allows producers to estimate damage caused by greenbug and easily sample fields for them. Current efforts are designed to build awareness among growers and train them to use Glance ?n Go through field days, workshops and newsletters. In 2011, these five stated began developing an "iWheat" program to further extend the adoption of Glance n Go by providing it through Web 2 technologies, and by developing a Glance n Go system for Russian wheat aphids. The purpose of iWheat is to provide a platform for growers to share real-time data on developing infestations of insects, diseases and weed problems. Current efforts revolve around surveying producers from the five states to measure their knowledge of Web 2.0 technologies. Over the next three years, we will provide educational programs demonstrating how this system can work, and follow up with measurement of adoption and impact.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area

133	Pollution Prevention and Mitigation
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #5

1. Outcome Measures

OKLHAOMA RANCHERS GET HELP WITH MUSK THISTLE CONTROL

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The invasive weed, Musk thistle (Carduus nutans L) was first identified in Oklahoma in 1944, and is currently found in more than 62 counties. Infestations of musk thistle in improved pastures cause significant economic losses in Oklahoma. In 1998, Oklahoma legislators passed a law designating musk thistle, along with scotch and Canada thistles, as noxious weeds in all counties of the state.

What has been done
A musk thistle IPM program was developed in the early 1990s and has been implemented statewide through cooperative efforts of researchers, Extension personnel, and landowners. It focuses on increasing public awareness of the problem, development of educational information, demonstrating various control options, and introducing new biological control agents. Two demonstration and educational meetings were conducted in 2011 to landowners and NRCS employees. Extension educators and landowners collected approximately 27,000 musk thistle head weevils and 3,000 musk thistle rosette weevils in Alfalfa and Grant counties in spring of 2011 for redistribution.

Results
To date, this program collected and redistributed more than 880,000 musk thistle head weevils and 42,910 musk thistle rosette weevils across the state. Landowners in NE Oklahoma have

noted from 80% to 95 % decrease in number of musk thistle plants in areas where they are using an integrated approach that includes use of the musk thistle weevils. If the typical landowner applies 1 lb active ingredient of herbicides per acre annually, biological control has decreased the amount of herbicides applied to the environment by 7.1 million lbs per year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

IMPROVING THE CONTROL OF DISEASES AFFECTING PERENNIAL HORTICULTURE COMMODITIES IN OKLAHOMA

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Turf pathogens cause diseases of commercial turf and golf courses and are a significant concern for many turf managers in Oklahoma. Diseases like dollar spot of turfgrasses, can result in significant damage to plants requiring expensive inputs on the part of the grower/manager. The horticulture turf pathology research and extension program at Oklahoma State University conducts research to develop sustainable methods for controlling this disease and delivers the resulting information to stakeholders via the extension program.

What has been done
A dollar spot disease model was developed based on research trials conducted in Oklahoma and in Wisconsin. A logistic regression-based model was developed using both datasets. Separate validation experiments in both locations in 2009 and 2010 resulted in a significant savings of fungicide sprays without compromising disease control. As a result of these research experiments, funding was obtained from the United States Golf Association to validate the model in five locations throughout the U.S. (Oklahoma, Wisconsin, Mississippi, Tennessee, and

Pennsylvania).

Results
Results from the 2011 trials indicate that an average of one fungicide spray was saved across all locations without compromising disease control. This can result in several thousands of dollars in savings per fungicide spray.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #7

1. Outcome Measures

Detection, Geographic Variation, and Management of Phosphine Resistance for IPM of Stored Grain Insects

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Total wheat (Triticum aestivum L.) production of Southern U.S. states in 2011 was 334 million bushels, with a total value of $2.1 billion. Most of the wheat grown in this region is hard red winter wheat, which is highly valued for bread-making and commands top price when grade quality factors are high and damage after harvest is low. Three most important insect pests of stored wheat in Southern U.S. are, in order, lesser grain borer (Rhyzopertha dominica (F.)), rusty grain beetle (Cryptolestes ferrugineus (Stephens)), and red flour beetle (Tribolium castaneum (Herbst)). The risk posed by these insects in Southern U.S. is particularly high because of the longer period of grain storage and higher ambient air temperatures compared to other wheat-producing regions that are more northerly. Therefore, storage managers rely on IPM and use tactics such as sanitation, aeration, and protectant insecticides, and phosphine gas, or hydrogen phosphide (PH3), is used when other management practices have failed. Phosphine is relatively

inexpensive, easy to apply, leaves no residues, and can be used in a wide range of storage types and commodities. Consequently, use of phosphine under less than ideal conditions that involve leaky structures has led to an increasing number of reported fumigation failures. Some of these fumigation failures may have been caused by phosphine resistance.

What has been done
A recent collaboration by Kansas State and Oklahoma State University stored grain entomologists confirmed very high levels of phosphine resistance in Oklahoma populations of red flour beetles and lesser grain borers. Resistance levels that were up to 119 and 1,519 times, respectively, higher than those of susceptible strains of these species were found. The presence of red flour beetle and lesser grain borer populations with strong resistance in Oklahoma could be an indication of the same in other parts of the Southern U.S. and U.S. in general, and an indication that it could develop in areas and other grains (sorghum, corn, and rice) where resistance may currently not exist but phosphine is being widely used.

Results
These findings call for a survey of red flour beetles, lesser grain borers, and rusty grain beetles in wheat storage facilities across the Southern U.S. in order to determine the presence and extent of phosphine resistance. Information obtained from the survey will aid the development of a phosphine resistance management strategy to ensure continued effective use of this fumigant that is extremely vital for IPM of stored-wheat insect pests in Southern U.S. and whole of the

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

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
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

We had a drought that was unprecedented from December 2010 through Sept 2011, it affected wheat, canola, cotton, and othe row crops. Reducing yield.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NA

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 12

1. Name of the Planned Program

Food Safety - Agricultural Biosecurity

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
211	Insects, Mites, and Other Arthropods Affecting Plants	20%		5%	
212	Pathogens and Nematodes Affecting Plants	10%		50%	
213	Weeds Affecting Plants	20%		0%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	25%		35%	
903	Communication, Education, and Information Delivery	25%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	1.5	0.0	3.0	0.0
Actual Paid Professional	0.5	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**
15000	0	71195	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
15000	0	71195	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
75000	0	393032	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

*Operate the **Oklahoma National Institute for Microbial Forensics and Agricultural Biosecurity**, a multi-disciplinary unit to support and address issues of crop and food biosecurity, and their impacts.

*Conduct **scientific research** targeted specifically towards plant pathogen forensics, sociological impacts of terrorism, and other areas of agricultural biosecurity

***Develop an academic "track"** for students seeking M.S. or Ph.D. degrees in established programs such as Plant Pathology, Biochemistry, Plant Sciences or Forensic Sciences, who seek plant pathogen forensics

Offer a short course on microbial forensics to prepare State educators, diagnosticians, researchers, extension agents, students and postdocs, producers and first detectors/responders

Develop an **undergraduate course in Agricultural Bbiosecurity**

2. Brief description of the target audience

Key members of National and Oklahoma homeland security community (DHS, FBI, CIA, etc)
Key members of National and Oklahoma agricultural leaders and representatives
Oklahoma extension personnel
Master gardeners
Oklahoma producers and crop consultants
OSU students and faculty
Professional/scientific societies
Key industries
The public

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	81	0	0	0

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

Patent Applications Submitted

Year: 2011
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	10	10

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of OSU faculty and staff affiliated with the new Oklahoma Center for Agricultural Microbial Forensics Biosecurity

Year	Actual
2011	40

Output #2

Output Measure

- Number of grant/contract proposals submitted in agricultural microbial forensics and biosecurity

Year	Actual
2011	27

Output #3

Output Measure

- Number of journal articles submitted with emphasis on agricultural microbial forensics and biosecurity

Year	Actual
2011	10

Output #4

Output Measure

- Workshops to develop the discipline of plant pathogen forensics, train "first responders", and state and national stakeholders

Year	Actual
2011	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of invitations to agricultural biosecurity team members for participation in initiatives, programs, presentations, and consultations related to agricultural biosecurity and microbial forensics
2	Number of forensics-relevant journal articles published
3	Percentage of agricultural producers, handlers and processors employing at least one new (to them)practice to enhance biosecurity

Outcome #1

1. Outcome Measures

Number of invitations to agricultural biosecurity team members for participation in initiatives, programs, presentations, and consultations related to agricultural biosecurity and microbial forensics

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	46

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A biological attack on United States crops, rangelands or forests could have severe impacts. Biocrimes, perpetrated for economic gain, are even more likely. Preparedness requires a strong national security plan that encompasses microbial forensics and criminal attribution. However, U.S. crop producers, consultants and agricultural scientists, unaccustomed to the possibility of intentional pathogen introduction, traditionally focus disease management strategies on prevention, rapid eradication or long-term management. New information, technologies and resources in microbial forensics (human, livestock and plant) are needed to enhance the nation?s preparedness and responsiveness to plant health emergencies.

What has been done
Scientists make presentations to technical groups to advise of research advances and as educational programs.

Results
(1) As a National Bioforensic Analysis Center (NBFAC) Spoke Laboratory, the NIMFFAB developed highly validated real time PCR protocols for three plant pathogen models. We optimized assay conditions for each pathogen, validated them against panels of taxonomic and geographical near neighbors, and created artificial positive controls for each assay. Validated protocols were delivered to NBFAC and peer reviewed publications are in preparation.
(2) Molecular strain discrimination technologies, including Variable Number Tandem Repeats (VNTR), Multi-Locus VNTR Analysis (MLVA), and single nucleotide polymorphism (SNP) protocols, were adapted for plant pathogens Pseudomonas syringae pv. tomato, Serratia marcescens, and Wheat streak mosaic virus. These methods allow fine discrimination among pathogen strains for applications in forensic microbiology. 2011 outcomes: 1 Ph.D. thesis; one manuscript submitted.

(3) NIMFFAB completed the development of a Crop Bioagent Introduction Intent Assessment Tool, a survey tool for use by non-scientists in the evaluation of an agricultural incident having hallmarks of human tampering. The tool was validated by panels of first responders using field outbreaks of Wheat streak mosaic virus.
4. PCR primers were designed and tested for discrimination of whitefly, Bemisia tabaci, biotypes and the morphologically indistinct Trialurodes vaporarium. These primers distinquish between the endemic A biotype and the invasive B and Q biotypes.
5. E-probes for quick identification of pathogen unknowns using massively parallel sequencing were developed for three model plant pathogens.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Number of forensics-relevant journal articles published

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Fresh produce has been and will likely continue to be associated with foodborne illness outbreaks. Several critical knowledge gaps have to be filled before a fundamental effort can be made in control of contamination of fresh produce by foodborne pathogens. One such gap is the knowledge of microbial communities on and around fresh produce through its production chain, from farm to fork. These issues are critical for the consumer, as well as to Federal agencies charged to ensure a safe and secure food supply.

What has been done

Results

1.Researchers determined that blow flies (Family Calliphoridae) acquire and transmit E. coli O157:H7 and Salmonella enterica from contaminated manure to lettuce. Transmission rate differed between the two pathogens, suggesting specific interactions between human enteric bacteria and insect cuticle.

2.Blow fly transmission from Salmonella-contaminated manure to fruit was demonstrated. Blow flies differentially transmitted S. entrica to tomatoes (low), grapes (low) and blueberries (high) suggesting differential release of pathogens from cuticle.

3.A metagenomic analysis of blow fly excreta revealed numerous bacterial, fungal, and viral sequences suggesting hundreds of bacterial species, viruses, and bacterial phages existed in the sample. This has implications for fly vector status and possible foodborne illness transmission to plants.

4.Researchers compared plant structural parameters of spinach grown under fast- and slow-growth conditions. Cell walls and thickness of leaves was higher in the slow-growth spinach. Leaf cuticular waxes also differed between the two growth types. We also tested leaf strength and found that slow-growth spinach was more flexible and tear resistant, particularly after a 1 hour wilt period compared to fast-growth spinach. This may explain the lower incidence of spinach breakage in spinach grown during the winter and spring months in the Salinas Valley of California and is may be correlated with fewer human pathogen outbreaks in this crop.
5.Microbial communities on tomatoes was investigated and it was determined that microbial diversity was lower than expected.

6.Cantaloupe invasion by Salmonella was not found to be facilitated by the plant pathogen Erwinia tracheiphila. However, subepidermal movement of GFP-tagged Salmonella showed dispersal from the site of inoculation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Percentage of agricultural producers, handlers and processors employing at least one new (to them)practice to enhance biosecurity

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Important national research and policy initiatives in homeland security have engendered a need for additional personnel, trained and experienced in fields such as microbial forensics and food safety. The Bureau of Justice Statistics (BJS) recently identified an increasing backlog of forensic casework due to a shortage of forensic analysts. The BJS?s call for 20% more traditional analysts is compounded by the additional need for analysts in the newly emerging sub-disciplines of microbial and agricultural forensics. In addition, there is a need for those in federal agencies, Cooperative Extension, and law enforcement, to receive training specifically related to response in a plant health emergency, and to practice their respective roles and responsibilities.
Note: Most of the OSU faculty and staff on the Agricultural Biosecurity Team have appointments with high percentages in research. The metrics required for the NIFA report involve documentation of changes in methods, practices, suppliers, etc. through surveys, personal contacts, etc. In the past, research personnel have not used surveys to measure and document such changes. Although many of the Ag Biosecurity team members have plans to use such surveys in conjunction with extension/outreach activities, we do not have such results for 2011.

What has been done

Results

1.The course, ENT/PLP 2143, "Global Issues in Agricultural Biosecurity and Forensics" will be taught for the second time as ENT/PLP 4400 during the spring of 2012. The aim is to introduce undergraduate students to the fundamental components of an effective agricultural biosecurity system by providing insights and practical understanding about how all components of a biosecurity system operate and integrate, facilitating the understanding of the relevance of the sciences involved in agricultural biosecurity and microbial forensics. This course provides broad information to a variety of majors, but also serves as a springboard for students considering careers in agricultural biosecurity, microbial forensics, related research, or roles in agricultural biosecurity agencies. Areas covered are:
a.Scientific and political definitions of biosecurity in its broad sense, to include microbial forensics, bioterrorism, biowarfare, biosafety, invasion biology, emerging pathogens, and invasive species.
b.Quarantine, response and surveillance.
c.Detection, diagnostics and forensics technologies.

2.A training session, "Plant Pathogens of National Importance and Other Invasive Species", was presented for U.S. army troops (approximately 20) from Oklahoma, soon to be deployed to Afghanistan.

3.NIMFFAB presentation at DASNR's Day at the Capitol, April 2011. This DASNR wide representation was designed to bring information about NIMFFAB programming to Oklahoma legislators.

4.The Plant Disease and Insect Diagnostic Laboratory continues to operate as a hub diagnostic lab for the Great Plains Diagnostic Network. Diagnosticians Jen Olsen and Richard Grantham participated in National Plant Diagnostic Network activities/training and continue in readiness for plant health/invasive species emergencies.

5.One workshop on primer design were presented at Oklahoma State University. The goal of the workshop was to teach researchers how to design more specific primers for more sensitive detection of pathogens.

6.An all day session teaching forensic entomology to junior high biology classes (80 students) was held at Perkins-Tryon Middle School.

7.As the Outreach component of a USDA NIFA Ag Biosecurity grant, a one day workshop on microbial forensics "CSI style" was held for 4-H junior and senior high school students at NIMFFAB laboratories and OSU farm sites. The objective was for students to collect data at a plant pathogen crime scene, learn chain of custody procedures and techniques, isolate DNA and conduct a forensic analysis. Twenty five students and adults participated in this highly successful workshop.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

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
- Other (exotic pathogens, terrorism)

Brief Explanation

1. The FBI Scientific Working Group on CBRN Threats, established in 2003 to foster inter-agency communication and to gain academic and industry contributions to the

development of the field of microbial forensics, was discontinued. This action affects the number and quality of NIMFFAB interactions with the FBI.

2. Increased restrictions on the ability of foreign nationals to work on certain biosecurity-related (and dual use) projects funded by federal security agencies has affected the ability of some NIMFFAB faculty to work on these projects and also has led to our stated preference for U.S. citizens when bringing faculty members, graduate students and postdocs into our programs.

3. USDA-CSREES has restructured the research priorities and framework for developing grants, moving towards larger, multidisciplinary programs in fewer emphasis areas. A number of programs were eliminated, most notably the NIFA NIFSI (National Integrated Food Safety Initiative).

4. A number of high-profile food-borne pathogen outbreaks occurred in 2011, continuing a multi-year trend in the increase of foodborne illnesses, most notably the cantaloupe outbreak of Listeria monocytogenes and a new strain of pathogenic E. coli in Germany. As a result, food safety was named as one of the major S&T focus areas for the Obama administration (and a priority for the White House Office of Science & Technology Policy). Further, food safety also was named as one of the five major Emphasis Areas for 2011 NIFA proposals. These factors place NIMFFAB food safety researchers in a position to take advantage of potential new funding streams.

5. Significant cuts in Federal spending on biosecurity resulted in a change in our Memorandum of Understanding with the National Bioforensic Analysis Center. Although NIMFFAB remains an official "Spoke Laboratory" of the NBFAC we are not currently receiving funding from them for specific research or deliverables. It is hoped that our
projects can be picked up again when funds become available.

6. The new Food Safety Modernization Act mandates that the FDA develop new regulatory policy on food contamination by human pathogens, intensifying the agency's desire for targeted research to provide the scientific foundation for new regulations and focusing more USDA and NIH funding attention on food safety research.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

NA

Key Items of Evaluation

1. A training session, "**Plant Pathogens of National Importance and Other Invasive Species**", was presented for U.S. army troops (approximately 20) from Oklahoma, soon to be deployed to Afghanistan.

V(A). Planned Program (Summary)

Program # 13

1. Name of the Planned Program

Structure and Function of Macromolecules

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		20%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		20%	
206	Basic Plant Biology	0%		20%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		5%	
212	Pathogens and Nematodes Affecting Plants	0%		5%	
304	Animal Genome	0%		5%	
305	Animal Physiological Processes	0%		10%	
311	Animal Diseases	0%		5%	
312	External Parasites and Pests of Animals	0%		5%	
501	New and Improved Food Processing Technologies	0%		5%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	3.0	0.0
Actual Paid Professional	0.0	0.0	8.5	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**
0	0	402407	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	402407	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	2221486	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Basic research will be conducted that will make fundamental discoveries which will enhance our understanding of molecular mechanisms involved in the regulation of physiological processes in plant and animal systems.

- New faculty and staff will be recruited to build, foster and maintain a cohesive critical mass of research faculty with a diverse set of expertise that focus on the study of structural biology.

-Grant proposals will be written to acquire and maintain state of the art equipment to enhance the research capabilities relating to protein structure/ function/ interactions on the OSU campus.

- Funds will be applied for/ solicited from national, state and university sources to acquire, maintain and restore support for "Core" facilities that are critical to the research mission of DASNR and Oklahoma State University.

-Proposals will be submitted to attract sufficient extramural support to establish an extramurally funded "Structural Biology" Center at OSU that will stimulate collaborations and research productivity.

- Design and conduct basic research to fill critical gaps in scientific knowledge that will address needs, issues and problems that ultimately can be translated into an improvement in plant and animal health.

- Develop new research methods and procedures
- Train undergraduate and graduate students, and postdoctoral associates
- Publish scientific articles
- Write and submit grant proposals
- Attend and present scientific findings at professional meetings
- File patents for protection of intellectual property and negotiate licensing agreements for technology transfer
- Interact with other researchers both on and off the OSU campus.

2. Brief description of the target audience

Team members
- Departments and department heads
- OSU administrators
- Other faculty and other scientific researchers in DASNR, at OSU & the scientific community
- Students and post-docs
- Federal, state, and private funding agencies
- Scientific journal editors, readers & the scientific community
- Candidates for open faculty and staff positions.
- Patent officers

- Agricultural, environmental, life, and human science industries
- General public and elected officials

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	25	25

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of manuscripts submitted based on reserach efforts

Year	Actual
2011	25

Output #2

Output Measure

- Number of extramural grants submitted with preliminary data from research efforts

Year	Actual
2011	15

Output #3

Output Measure

- Number of presentations given at meetings and conferences to disseminate research results

Year	Actual
2011	28

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of graduate students graduated and postdoctorial associates mentored in structural biology
2	Number of manuscripts published
3	Number of invitations faculty receive to present research findings at universities and colleges and national and international meetings

Outcome #1

1. Outcome Measures

Number of graduate students graduated and postdoctorial associates mentored in structural biology

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Society needs scientists and engineers.

What has been done
Training of graduate students in sciences.

Results
6 students graduated with M.S. or Ph.D. degrees. 35 additional students are currently enrolled in graduate degree programs. 6 post graduate students are in fellowship (post doctoral) positions and in training.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
304	Animal Genome
305	Animal Physiological Processes
311	Animal Diseases
312	External Parasites and Pests of Animals

501 New and Improved Food Processing Technologies

Outcome #2

1. Outcome Measures

Number of manuscripts published

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	25

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Results of research must be circulated publicly so that the gains in knowledge are share among members of society.

What has been done
Research scientists submit and publish articles in high impact journals circulated globally.

Results
25 articles published in high impact peer review journals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
304	Animal Genome
305	Animal Physiological Processes
311	Animal Diseases
312	External Parasites and Pests of Animals

501 New and Improved Food Processing Technologies

Outcome #3

1. Outcome Measures

Number of invitations faculty receive to present research findings at universities and colleges and national and international meetings

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	14

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research results circulated among the research community garner interest based on relevance and creativity. Impact of results can be judged by the number and types of invitations received to present results of research to other research scientists.

What has been done
Research scientists are invited by outside groups to present results of work conducted.

Results
14 presentation were made to groups by invitation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
304	Animal Genome
305	Animal Physiological Processes
311	Animal Diseases

312	External Parasites and Pests of Animals
501	New and Improved Food Processing Technologies

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Competing Public priorities

Brief Explanation

State and federal appropriations for science research are declining and this has a negative effect on the research groups ability to garner funding to conduct research projects.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Despite reductions in state and federal allocations for research, the research group has met or exceeded funding goals previously set by research scientists. Similarly, despite reducations in funding allocations, scientists have continued to publish and present results of their work.

Key Items of Evaluation

Publication and funding goals were met or exceeded. Both measures indicate that the research conducted meets the needs of society as judged by peer review systems.

V(A). Planned Program (Summary)

Program # 14

1. Name of the Planned Program

Global Food Security and Hunger - Farm and Agribusiness Systems Economics

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management	39%		60%	
602	Business Management, Finance, and Taxation	15%		10%	
603	Market Economics	20%		10%	
607	Consumer Economics	8%		10%	
610	Domestic Policy Analysis	18%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	6.0	0.0	3.0	0.0
Actual Paid Professional	7.0	0.0	1.3	0.0
Actual Volunteer	0.1	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**
130000	0	61909	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
130000	0	61909	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
840000	0	341767	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research based information developed

Decision aids developed that assist farm and agribusiness managers in improved decisions

Educational programs conducted that improve the management skills of farm and agribusiness managers

Farm and agribusiness managers are able to better understand economic consequences and make more informed decisions

2. Brief description of the target audience

Managers, owners, and employees of farms and agribusinesses

3. How was eXtension used?

Annual appropriation for the CTP in FY 09 was $400,000. Appropriations were reduced to $372,000 for FY '10 and reduced to $330,000 for FY '11. These reductions are reducing programs, travel, publications, hence, outcomes and impact.

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6917	350000	110	5000

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	57	16	73

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of board members of farmer-owned cooperatives receiving credentialed director training for board goverence

Year	Actual
2011	35

Output #2

Output Measure

- Number of software decision analysis aids developed

Year	Actual
2011	7

Output #3

Output Measure

- Number of manuscripts submitted to refereed journals

Year	Actual
2011	62

Output #4

Output Measure

- Number of farm income tax managment schools conducted

Year	Actual
2011	11

Output #5

Output Measure

- Number of economists trained at other universities to deliver packer-feeder workshops and classes

Year	Actual
2011	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of tax preparers using information from OCES tax schools
2	Number of credentialed board members serving on agricultural cooperative boards (cumulative)
3	Number of beef producers applying some level of financial management decision skills learned through Master Cattleman certification
4	Number of specialty crop producers and goat producers improving farm management and/or financial management skills
5	Improved Price Discovery
6	Grain Grading Schools - Number of Agribusiness personnel certified

Outcome #1

1. Outcome Measures

Number of tax preparers using information from OCES tax schools

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1960

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Frequent changes in Federal and Oklahoma State Tax Laws create a need to keep tax preparers informed of the impact of the changes and how to best help their clients utilize the tax planning and management opportunities available in the current tax laws. These tax schools are designed to update tax preparers about new laws and regulations covering farm, non-farm business and individual taxpayer issues.

What has been done
This program has been conducted for the past 46 years. It has grown from a one-day seminar to its present form of two days per location for the fall Farm and Business Tax Institutes and the summer Tax Clinic. The combination of all the schools allows a preparer to get the full 40 hours of CPE/CLE as required by state. Topics covered range from presentation of new tax laws and their implications, agricultural issues, business issues, tax planning opportunities, professional ethics, retirement, and social security to name a few. Twelve two day sessions are conducted each year with two of these in the summer and ten in the fall and two one day special topics courses. Total 2011 attendance for the schools was approximately 1,960 tax preparers in 11 workshops. Certified public accountants make up 46 percent of the attendance, 27 percent are tax preparers and bookkeepers, 10 percent are enrolled agents, 2 percent are attorneys, and the remaining 15 percent come from a variety of backgrounds. These tax preparers file roughly 80 percent of the farm returns for taxpayers in the state of Oklahoma.

Results
High quality, professional instruction is provided to make continuing education credit available for Certified Public Accountants, Enrolled Agents, and Tax Attorneys. Many of those attending have stated that they have been coming to these programs since they began. Participants filed more than 37,645 Federal farm tax returns and 255,428 Federal non-farm tax returns as reported by the participants in the most recent program evaluations. Most of the tax preparers that attend are

from Oklahoma however there have been preparers from Kansas, Texas, New Mexico, Arkansas, Florida, and California attending the program in order to maintain their Oklahoma accreditation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation

Outcome #2

1. Outcome Measures

Number of credentialed board members serving on agricultural cooperative boards (cumulative)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	151

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The board of directors of an agricultural cooperative has responsibility for strategic decisions and for safeguarding the organizations assets. Agricultural cooperative board members are producers who are elected by the membership to serve with only token remuneration. In recent times, all board members, including cooperative board members are under intense scrutiny. The incidence of legal proceedings against board members has increased dramatically. These litigations are typically initiated by owner (member) groups and they focus on the competency and diligence of the board. The severe repercussions from errant business decisions and the intense scrutiny of board member competency have created a critical need for educational programs.

What has been done
In response to the critical need to improve the competencies of cooperative board members the Oklahoma Credential Cooperative Director (OCCD) program was created. The OCCD program involves two days of training on finance, legal responsibilities, parliamentary procedure, effective meeting management, strategic planning and other related topics. In designing the OCCD curriculum, board of director training material from across the U.S. was examined. OCCD instructors include OCES faculty as well as industry experts including bankers, auditors, attorneys and consultants. The OCCD program is delivered simultaneously at a central location and via two-way interactive video at eight remote locations across Oklahoma.

The OCCD program was initiated in November of 2001 Since then it has been offered eleven times (spring and fall) with nine advanced sessions. Over 3600 directors have attended the Credentialing sessions and over 1,000 directors have returned for advanced training.

Results
The directors completing the OCCD program have a better understanding of financial management and the legal roles and responsibilities of the board of directors and are able to make better business decisions and to safeguard the assets of their cooperative organizations. Currently there are over 150 Credentialed directors representing 44 cooperatives and over 150 more directors who are progressing through the credentialing training. Over 400 directors from 37 separate cooperatives have attended an advanced session. Twenty cooperatives have achieved the status of having every board member credentialed. The typical Oklahoma cooperative includes 1,500 or more farmer members and organizational assets of over $10M. The OCCD program impacts thousands of Oklahoma producers by enhancing the board?s ability to manage and safeguard cooperative assets

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation

Outcome #3

1. Outcome Measures

Number of beef producers applying some level of financial management decision skills learned through Master Cattleman certification

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	71

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Production management, business planning, risk management and marketing are major issues for the beef producers who comprise Oklahoma's #1 agricultural industry.

What has been done

Agricultural Economics developed a comprehensive educational program in cooperation with Animal Science, Plant and Soil Science, Vet Med, Biosystems and Ag Engineering . The OSU Master Cattleman Program was launched in 2004 with the objective of enhancing the profitability of beef operations and the quality of life of beef producers by equipping them with vital information on many aspects of beef production, business planning, risk management and marketing. The educational curriculum is based on the Oklahoma Beef Cattle Manual. PPTs and lesson plans are available to educators via the Master Cattleman website. Producers must complete 4 hours in each of 6 subject matter areas plus an additional four hours of instruction or special projects. Local Extension educators plan and organize the Master Cattleman educational series and select the specific curriculum offered.

Results
71 producers were certified under the OSU Master Cattleman Program in 2011

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #4

1. Outcome Measures

Number of specialty crop producers and goat producers improving farm management and/or financial management skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	50

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Production management, business planning, risk management and marketing are major issues for meat goat producers. Meat goat production is an important enterprise for small and medium scale farmers and for those beginning a farming operation.

What has been done

The Oklahoma Meat Goat Boot Camp is a three day camp that uses the combination of classroom exercises and hands-on instructions about the different production practices involved in a meat goat operation. Production practices include but are not limited to ear tagging, castrating, tatooing, hoof trimming, electric fence building, forage testing, forage production, farm business planning, nutrition, ration balancing, FAMACHA, determining fecal egg counts, herd health practices, kidding, neonatal care, reproduction and pregnancy determination using ultra sound. Class size is small to facilitate teacher-participant interaction.

Results

50 producers from 11 states participated in the meat goat boot camp in 2011. The participants knowledge and understanding of a wide range of production issues including: parasite management and control, record keeping, general herd management including herd health, herd nutrition, forages and forage production systems, marketing and business planning were measured by administering tests before and subsequent to the training. Average test scores improved from 58% correct to 80% correct. While it is difficult to place a dollar value on the knowledge gain, it is obvious that the educational program increased the efficiency and profitability of the participants operations.

In an attempt to measure the amount of knowledge gained during the 2011 Oklahoma Meat Goat Boot Camp (Boot Camp), a 30 question test multiple choice/true-false test was developed by the instructors of the Boot Camp. Each question was taken from the material that was going to be presented at the Boot Camp. This test was then given to each participant at the beginning and the end of the Boot Camp. The following are the results:

Results

TestAverage ScoreRange% Correct
Pre-Test17.310-2457.5%
Post-Test24.017-2980.0%

The results show that participants improved their test scores by 38.7%.

Further, we can group the 30 questions into 7 areas of production and management. Then we can look at the test scores to determine which areas the group were the most and least knowledgeable before the Boot Camp and which areas had the biggest improvement in knowledge gained. The seven areas are as follows:

1.Parasite Management and Control
2.Record Keeping
3.General Herd Management including Herd Health
4.Herd Nutrition
5.Forages and Forage Production Systems
6.Marketing
7.Business Planning

Test Results
% Correct
GroupPre-TestPost-Test% Change
1. Parasite58.1%77.3%+32.9%
2. Record Keeping83.7%78.4%-6.3%
3. Herd Mgmt76.2%96.3%+26.4%
4. Nutrition29.7%69.3%+133.8%

5. Forages53.0%71.8%+35.4%
6. Marketing41.9%77.3%+84.6%
7. Business Planning45.3%71.6%+57.9%

The group with the largest increase in knowledge gained was the Nutrition with an increase of 133.8% followed by Marketing and Business Planning with 84.6% and 57.9% respectively. These three groups were also the three groups that the participants scored the lowest on during the pre-test. The participants strongest areas were Record Keeping and General Herd Management, but there was still a 26.4% increase in knowledge in General Herd Management.

The five questions that had the largest change in knowledge gained were as follows:

% Correct
QuestionPre-TestPost-Test% Change
1Soybean meal is considered better than cottonseed meal because it typically has a crude protein analysis of?4.7%52.3%1023.4%
2What are the three W?s of marketing?16.3%81.8%402.6%
3How many pounds of nitrogen does it take to produce 1 ton of forage?9.3%31.8%242.0%
4How many de-wormers are currently legal for producers to use in their goats?39.5%95.5% 141.4%
5For optimum reproductive efficiency goats should be in what body condition score range at the time of breeding?44.2%97.7%121.2%

See Evaluation for better view - this entry does not take tables!

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #5

1. Outcome Measures

Improved Price Discovery

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	125

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Price discovery is consistently cited as a critical issue in the beef industry. Increasing consolidation of buyers and changing pricing methods have heightened the need for producers, cattle feeders and affiliated agribusiness professionals to understand fed cattle market dynamics, the behavior of buyers and sellers, and alternative pricing methods.

What Has Been Done:
The Fed Cattle Market Simulator was developed at Oklahoma State University in 1990 and has been used in all three missions of the Land Grant University mission of teaching, extension, and research.

While the focus of simulation workshops is on price discovery, participants also learn the importance of several economic concepts, including value of information, market dynamics, breakeven analysis, derived demand, production efficiency, economies of size, hedging and risk management, and industry behavior and performance. This one-of-a-kind market simulator is used for groups of 24-48 people. The team has conducted workshops with persons as young as teenagers to persons in corporate executive management positions. Workshops of four hours are most common, but more in-depth, intensive workshops are offered to some groups, up to two-day sessions at large agribusiness corporations. Numerous extension and research publications have been written concerning the Fed Cattle Market Simulator in classroom teaching, extension education, and experimental simulation research.

What has been done
The Fed Cattle Market Simulator was developed at Oklahoma State University in 1990 and has been used in all three missions of the Land Grant University mission of teaching, extension, and research.

While the focus of simulation workshops is on price discovery, participants also learn the importance of several economic concepts, including value of information, market dynamics, breakeven analysis, derived demand, production efficiency, economies of size, hedging and risk management, and industry behavior and performance. This one-of-a-kind market simulator is used for groups of 24-48 people. The team has conducted workshops with persons as young as teenagers to persons in corporate executive management positions. Workshops of four hours are most common, but more in-depth, intensive workshops are offered to some groups, up to two-day sessions at large agribusiness corporations. Numerous extension and research publications have been written concerning the Fed Cattle Market Simulator in classroom teaching, extension education, and experimental simulation research.

Results
The simulator has been the basis for an OSU course offered once a year for 14 years. It has been the basis for marketing workshops with over 100 groups of 25 or more participants. One of the largest agribusiness firms has incorporated it into its annual employee training program. The developers have conducted 18 workshops with its managers from sales, procurement, and corporate operations. The developers have conducted producer workshops in 17 states, two provinces in Canada, and one state in Mexico, including 8 times at the national convention of the National Cattlemen's Beef Association. Over 20 workshops with producers have been conducted in Oklahoma. A large foundation in Oklahoma has included the simulator in its annual AgVenture

youth camp for the past 9 years. Agricultural economists in other states have adopted the software for use in classroom teaching and extension education programs (Colorado State University, Iowa State University, Kansas State University, Sam Houston State University, South Dakota State University, Texas A&M University, Texas Christian University, and University of Kentucky). During 2011, 3 workshops were conducted with over 125 participants.

Workshop evaluations clearly indicate the value of the simulator in teaching economics concepts. Anecdotal evidence indicates the market simulator changes attitudes about how markets work and why; increases knowledge and understanding of pricing methods for various genetic types of cattle; and enhances the bargaining skills of producers. Evaluation comments indicate the market simulator aids participants to better understand price discovery.

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics

Outcome #6

1. Outcome Measures

Grain Grading Schools - Number of Agribusiness personnel certified

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	400

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
An OSU research team sampled over 3600 trucks delivering grain during harvest The OSU research indicated that grain elevator personnel underestimated dockage, foreign material and over estimated the test weight in loads of grain delivered at harvest. The ten percent of producers delivering the highest quality grain were under compensated by $.05/bushel while the 10% of producers delivering the lowest quality loads were over compensated by $.22/bushel. This price distortion which totaled more than $13M/year reduced the incentive for producers to deliver cleaner, better grain. Inaccuracies in grading hinder communication and increase procurement risk all through the grain supply chain.

What has been done
OSU personnel designed a new hands-on grain grading school. Grain grading school participants received classroom instruction on grain grading principles and federal grain standards.

Results
In addition to classroom style teaching participants also grade a series of grain samples and compare their results with official grain inspection service grades on the same samples. As a result of the workshops, grain grading accuracy improved, reducing risks for both producers and grain handling firms. The grain pricing system became more efficient, increasing the premiums for producers delivering high quality grain. Over 400 agribusiness personnel attended and were certified at one of the nine grain grading schools offered in 2011.

4. Associated Knowledge Areas

KA Code	Knowledge Area
603	Market Economics

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
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The following is a summary of the pre and post test scores given to the participants of the 2011 Oklahoma Meat Goat Boot Camp in Ada, Oklahoma.

Methodology

In an attempt to measure the amount of knowledge gained during the 2011 Oklahoma Meat Goat Boot Camp (Boot Camp), a 30 question test multiple choice/true-false test was developed by the instructors of the Boot Camp. Each question was taken from the material that was going to be presented at the Boot Camp. This test was then given to each participant at the beginning and the end of the Boot Camp. The following are the results:

Results

Test	Average Score	Range	% Correct
Pre-Test	17.3	10-24	57.5%
Post-Test	24.0	17-29	80.0%

The results show that participants improved their test scores by 38.7%.

Further, we can group the 30 questions into 7 areas of production and management. Then we can look at the test scores to determine which areas the group were the most and least knowledgeable before the Boot Camp and which areas had the biggest improvement in knowledge gained. The seven areas are as follows:

1. Parasite Management and Control
2. Record Keeping
3. General Herd Management including Herd Health
4. Herd Nutrition
5. Forages and Forage Production Systems
6. Marketing
7. Business Planning

Test Results

% Correct

Group	Pre-Test	Post-Test	% Change
1. Parasite	58.1%	77.3%	+32.9%
2. Record Keeping	83.7%	78.4%	-6.3%
3. Herd Mgmt	76.2%	96.3%	+26.4%
4. Nutrition	29.7%	69.3%	+133.8%
5. Forages	53.0%	71.8%	+35.4%
6. Marketing	41.9%	77.3%	+84.6%
7. Business Planning	45.3%	71.6%	+57.9%

The group with the largest increase in knowledge gained was the Nutrition with an increase of 133.8% followed by Marketing and Business Planning with 84.6% and 57.9% respectively. These three groups were also the three groups that the participants scored the lowest on during the pre-test. The participants strongest areas were Record Keeping and General Herd Management, but there was still a 26.4% increase in knowledge in General Herd Management.

The five questions that had the largest change in knowledge gained were as follows:

% Correct

Question
Pre-Test
Post-Test
% Change

1

Soybean meal is considered better than cottonseed meal because it typically has a crude protein analysis of?

4.7%
52.3%
1023.4%

2

What are the three W's of marketing?

16.3%
81.8%
402.6%

3

How many pounds of nitrogen does it take to produce 1 ton of forage?

9.3%
31.8%
242.0%

4

How many de-wormers are currently legal for producers to use in their goats?

39.5%
95.5%
141.4%

5

For optimum reproductive efficiency goats should be in what body condition score range at the time of breeding?

44.2%
97.7%
121.2%

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 15

1. Name of the Planned Program

Global Food Security and Hunger - Sensor-Based Technologies for Agricultural and Biological Systems

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	50%		10%	
205	Plant Management Systems	25%		25%	
307	Animal Management Systems	5%		15%	
402	Engineering Systems and Equipment	20%		50%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	2.0	0.0
Actual Paid Professional	1.5	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
30608	0	71195	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
30608	0	71195	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
200000	0	393032	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct research into nutritional and pest management needs of wheat, corn, cotton, native, improved pasture, and turf grass in relation to sensed properties. Conduct research into animal grazing system to optimally manage plant and animal subsystems. Conduct research to invent and improve sensors and control systems for agriculture production and processing systems. Conduct research to create decision support systems incorporating sensors into plant and production systems.

2. Brief description of the target audience

Crop and livestock producers, food processors, input suppliers, equipment manufacturers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	303	8105	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	15	15

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Training sessions and demonstrations for use of new technologies and applications

Year **Actual**

2011	40

Output #2

Output Measure

- New technology applications

Year	Actual
2011	2

Output #3

Output Measure

- Number of trained extension personnel using hand-held sensors with producers

Year	Actual
2011	30

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Commercialization of hardware/instrumentaion
2	Number of producers adopting and practicing sensor-based technologies
3	Number of acres where sensor-based technologies are applied

Outcome #1

1. Outcome Measures

Commercialization of hardware/instrumentaion

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Oklahoma pecans have a good reputation for quality of nutmeats, but also are known for containing larvae of the pecan weevil. Weevil damage can be so bad at times that Oklahoma pecans are severely discounted even to the point where no price is offered. Therefore, efficient and cost-effective pest management strategies have always been a focus for pecan researchers and growers.

Pecan can be attacked by more than twenty types of insects. Pecan weevil (Curculio Caryae) is one of the most destructive pests of the Oklahoma pecan. Its larva resides inside the nut and feeds on nutmeat. Sorting of defective nuts is not possible because nutmeat defects are not fully recognizable by physical properties, color and appearance of whole unshelled nuts. Commercial sorters are available to sort nutmeat after shelling the nuts, resulting in unnecessary shelling of defective nuts. This calls for development of automated inspection systems to identify good pecan nuts from defective ones before shelling them. Some sensing techniques which can look inside the nuts without breaking or opening them would be useful.

What has been done
Efforts continued on development of automated monitoring of pecan weevils. Work completed or in progress includes: 1.) Prototype wireless camera node was developed to test feasibility and performance of current technology for weevil emergence. 2.) Integration of an imager, lighting, and weevil positioning system into current weevil trap. 3.) Acquisitionof a set of images for training and testing of current and improved insect recognition techniques. New components were evaluated and used for in-field monitoring during the 2011 weevil emergence season. We collected additional image sets for continued insect recognition and classification work. Image processing routines were improved for identifying live insects in natural poses, where position and

orientation are variable.

We continued our work on x-ray imaging of in-shell pecans. A new local adaptive thresholding algorithm with a new hypothesis: reversing the water flow and a simpler thresholding criterion was developed. The new method reduced the computational time by 50-60% as compared to the existing fastest Oh method. The new method could segment both larger and smaller (presence of insect exit paths) defects. The algorithm worked well for other unimodal images taken from published research studies and it should be extendable to other food and agricultural images characterized by unimodal histogram and poor contrast.

Several papers were presented at the 2011 ASABE Annual International Meeting on both the wireless pecan weevil monitoring and the algorithm development for x-ray imaging of pecans. This research effort revised the radiation safety procedures, training and documents for the x-ray camera system and passed the x-ray certification process.

Results

Additional progress has been made in furthering the research to realize a wireless in-field insect monitoring system. Our understanding of weevil behavior has improved significantly, providing experience that will improve the efficacy of future work. Development of hardware and software has continued, with the realization that power consumption is an extremely difficult problem for wireless sensor systems.

Improved pattern recognition classifiers and other image processing algorithms have been developed to improve the feature classification accuracy. The newly developed local adaptive thresholding method can be extended to other food product images. This algorithm was published in 2011 in the Computers and Electronics in Agriculture journal.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
402	Engineering Systems and Equipment

Outcome #2

1. Outcome Measures

Number of producers adopting and practicing sensor-based technologies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
On a worldwide scale, nitrogen use efficiency (NUE) for cereal grain production is approximately 33%. This means that 67% of the applied nitrogen is not utilized by the plant. The use of sensors for crop management decisions is becoming more popular and more crop producers and consultants are exploring this technology.

What has been done
Ongoing work to develop a ?stick? planter for the 3rd world. This unit will be for those farmers that plant and fertilize corn by hand.
?Seed Orientation studies showed that corn seed planting geometry can influence leaf orientation. Using a specific geometry, leaf orientation can be manipulated so that leaves are always pointed perpendicular to the row. This allows for increased light interception, increased plant populations and that can increase grain yields. Automation of this mechanical process is ongoing.
?Optical Pocket Sensor developed and tested in Mexico, India, and USA, and that will ultimately cost only $600, versus $4000 for the current GreenSeeker.
?OSU/Trimble Navigation produced the new GreenSeeker 2 sensor.

Results
Optical pocket sensor developed, tested, and delivered to various worldwide locations, including many with CIMMYT staff. This will for many farmers replace the GreenSeeker sensor. Trimble Navigation has now met with us, and they will be building these commercially.

?Continued development/extension of sensor based N management practices in Ciudad Obregon, MX with Dr. Ivan Ortiz-Monasterio. SBNRC, GreenSeeker, and now pocket sensors now used in India, China, Mexico, Turkey, Canada, Kenya, Australia, Argentina, Uzbekistan, and Zimbabwe.

?The Sensor Based Nitrogen Rate Calculator now has 29 functional algorithms that are being used for improved fertilizer N recommendations in Mexico, Argentina, Turkey, India, Australia, Canada, India, Kenya, and Zimbabwe and many states in our country.

?Productivity in 2011 was close to 2006 and 2008 (#2 and #3 all time), and watershed years where more than 25 significant products/year including journal publications, degrees, books, book chapters, patents, workshops, web sites, grants, classes, and proceedings were delivered (Figure 1). Further extension of the N Rich Strip with BAE Faculty had a significant impact in 2011. This year, our recommendations for wheat farmers should result in extensive N savings.

N Algorithms Developed (Sensor Based Nitrogen Rate Calculator) (2011): 2
http://www.soiltesting.okstate.edu/SBNRC/SBNRC.php

New algorithms developed, placed on-line and that are now being used by producers in each respective region included

1.Winter wheat protein optimizer (option 28)
2.Winter wheat Phone (option 29)

Ammonia Loss calculator (surface applications of urea)
http://www.soiltesting.okstate.edu/SBNRC/Ammonia_Loss_Calculator.php

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Number of acres where sensor-based technologies are applied

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	500000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
INcludes U=users in Oklahoma, Other states and Mexico, Argentina, Turkey, India, Australia, India, Kenya and Zimbabwe

What has been done

Results

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Other (commercialization opportunities)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This team is being rolled into the crops enterprise planned programs for the future

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 16

1. Name of the Planned Program

Sustainable Energy - Bio-Based Products Development

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
511	New and Improved Non-Food Products and Processes	100%		100%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	4.0	0.0
Actual Paid Professional	1.0	0.0	5.5	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**
25000	0	260017	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
25000	0	260017	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
300000	0	1435422	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Project proposals
- Technical presentations

•Technical papers

•Journal articles

•Patents

•Products taken to commercialization by industry

2. Brief description of the target audience

Other scientists, industry, agricultural producers, commercial developers, pre-service teachers (those who are aspiring to become agriculture teachers in grades 6-12) and Oklahoma's county extension educators.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	277	50	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 1

Patents listed

PVP for switchgrass variety 'Cimarron'.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	5	33	38

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Journal Articles

Year	Actual
2011	38

Output #2

Output Measure

- Technical papers and presentations

Year	Actual
2011	102

Output #3

Output Measure

- New processes developed

Year	Actual
2011	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Products/processes taken to commercialization by industry
2	Feedstock Production
3	Conversion Technologies

Outcome #1

1. Outcome Measures

Products/processes taken to commercialization by industry

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Feedstock Development - Improving biomass yield is a major target trait for biofuel plant species. However, little progress has been made to-date. Because biomass production is a highly complex trait and the relevant genes/factors that control this trait have not been identified.

The leaf blade is the most important photosynthetic tissue in plants that converts carbon dioxide from the atmosphere and solar energy from the sun into chemical energy in the form of sugars. The leaf blade is, thus, like a solar panel where larger surface area increases photosynthetic efficiency and thereby leads to more biomass accumulation per acre. We have been studying leaf blade development in the model plant Medicago truncatula to understand the mechanism of this fundamental biological process in order to be able to engineer biofuel crops for biomass feedstock improvement.

What has been done
In our switchgrass research, we discovered that miR156 negatively regulates the expression of SPL transcription factors in plants and this regulation is required to promote vegetative phase transition to reproductive phase. We have identified a key transcription factor called STENOFOLIA (STF), critically required for blade outgrowth. Previous work in Arabidopsis indicated that lamina outgrowth is regulated by the interaction of polarity determining factors that are expressed either on the adaxial or abaxial domain of the leaf. Our work using the stf mutant in Medicago truncatula shows that lamina outgrowth is determined by a WOX gene, STF, expressed at the adaxial-abaxial boundary of the middle mesophyll and leaf margin. We further discovered that STF integrates hormonal and metabolic signals with development. Protein-protein interaction using a Yeast Two-Hybrid system shows that STF interacts with the abaxial polarity factor, KANADI (KAN). STF also interacts with AS2-like LOB domain proteins suggesting

that the effect of polarity genes on lamina outgrowth is mediated through STF. Experiments using transgenic plants revealed that STF expression restricted to the L1 layer only is unable to function in blade outgrowth, but expression at the L2/3 layer is sufficient to rescue the leaf blade mutant suggesting that STF probably regulates a mobile signal that non-cell autonomously regulates blade outgrowth in the upper mesophyll and epidermis. We have also successfully engineered Brachypodium distachyon plants with STF and produced transgenic leaves which are approximately twice the size of the wild-type leaf in width.

Results
By overexpressing miR156 in switchgrass, it was shown that tiller number are increased by 5-6 folds that in turn increase biomass production by 80-100%.

Our findings highlight the importance of STF as a central integrator of developmental and metabolic pathways significantly advancing our understanding of the molecular mechanism of leaf development which ultimately will lead to a deeper understanding of the mechanism of total biomass accumulation in plants. So, the major impact of this work is at the basic science level in advancing knowledge and preparing the foundation for successful manipulation of biomass in energy feedstocks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

Outcome #2

1. Outcome Measures

Feedstock Production

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

We have established multi-location testing of annual and perennial feedstocks. The amount of nitrogen required and best locations for each of the feedstocks are being assessed. New feedstocks including sugar beets, energy cane, and camelina were evaluated for their production performance in Oklahoma.

Results

The year 2011 was exceptionally dry and hot. The perennial crops on average produced 5-6 dry t ha-1, while annual crop like sorghum did not survive at several locations but was on par with perennials at locations where sorghum survived.

We successfully demonstrated that both sugar beet and energy cane survive Oklahoma winters and extreme dry conditions in summer with some supplemental irrigation. The yields of biomass and sugar of both winter and spring planted sugar beets are on par with national average 60-70 wet t ha-1. The brix values are also comparable (17-18%) with northern locations. Camelina can be grown as a spring planted crop but requires optimization of production practices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

Outcome #3

1. Outcome Measures

Conversion Technologies

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Biochemical

The state of Oklahoma has great potential for producing cellulosic feedstocks for ethanol production. Ethanol facilities should be located close to feedstocks to reduce transportation

costs, so the state also stands to benefit from having several ethanol production facilities. OSU and partners have developed a process to gasify biomass to produce CO and H2, which can be converted into ethanol by bacteria. However, this process suffers from several issues, such as low productivity, mass transfer limitations, and expensive media. Solutions for reducing medium cost, enhancing mass transfer of CO and H2 and improving the amount of ethanol produced by the bacteria are required.

What has been done

We have catalogued all of the enzymes that two fungi secrete when they are using sorghum stover as their sole carbon source. This should allow us to deduce which enzymes are necessary for conversion of sorghum stover to fermentable sugars. We have also determined which genes, from the entire genome of two different fungi, are induced to enable the growth of the fungi on sorghum stover.

Fermentation medium was designed for production of ethanol and acetic acid from synthesis gas by Clostridium ragsdalei, also called Clostridium strain P1. The medium was developed by serial deletion of components from the standard medium used for isolation and growth of the bacterium. Cost and purpose of individual components in the designed medium were considered to guide the revision of the medium recipe.

Hydrogen and carbon monoxide, sparingly soluble gases are transferred to reactive sites inside cells during fermentation of synthesis gas to fuel and chemicals. The rate of conversion is set by either the transfer of gas into the cell or the kinetics of reaction inside the cell. Gas consumption, cell growth and production of ethanol and acetic acid from synthesis gas, primarily CO, H2 and CO2, by Clostridium strain P11 was followed to observe the interplay of kinetic and mass transfer limitations in the course of fermentation. Fermentations were studied under various conditions of pressure, cell concentration, agitation, gas composition, and mass transfer techniques.

Fermentative production of ethanol from CO and H2 using new strains of "Alkalibaculum bacchi" CP11, CP13 and CP15 was studied in 250-mL bottles containing 100 mL of yeast extract medium at 37C and pH 8.0. Two commercial syngas mixtures were used (20% CO, 15% CO2, 5% H2, 60% N2) and (40% CO, 30% CO2, 30% H2). The three strains were fed syngas every 24 h for 15 days. Liquid samples were collected to measure pH, optical density (OD) and product concentrations. Gas samples were collected to measure the concentration of the gases in the head space and to calculate the product yields and conversion efficiencies of syngas components to ethanol.

Clostridium carboxidivorans has been identified as a bacterium that can effectively produce ethanol from CO2 and H2 in our studies. Also, a nutrient media was developed for the process. We also identified the proper temperature and substrate molar ratios for the greatest ethanol yields. Current efforts are being made to scale up the process and use hollow fiber membranes reactors for the fermentation to increase mass transfer.

Results

Several enzymes including feruloyl esterase, glucuronoyl esterase, cellobiose dehydrogenase, and the endoglucanases belonging to glycosyl hydrolase family 61 are implicated in facilitating the digestion of sorghum by cellulases and xylanases into fermentable sugars.

The results from medium design showed that Morpholinoethanesulfonic acid (MES), a buffer used

to maintain the pH near 6.0, can be eliminated from the medium. Instead, a buffer was formed from the acetic acid produced during the fermentation and addition of bicarbonate, keeping the pH around 4.75 to enhance ethanol production. The performance of fermentation without MES, with pH control using acetate buffer was similar to that from the original rich medium. This reduced the production cost by 95% compared to the standard medium. Additionally, yeast extract, an undefined growth promoter, was eliminated and trace metals for medium preparation were prepared in dilute solution without chelating agents. Fermentation without yeast extract resulted in lower growth, but comparable initial substrate uptake and production rates. Further, omission of cysteine from the medium and dependence on sulfide as nutrient sulfur source enhanced ethanol production, but did not sustain growth of strain P11. The control of pH in the designed medium and selection of appropriate sources of elemental nutrients is expected to enhance fermentation performance and further decrease cost.

Clostridium strain P11 consumed CO to greater than 95% converted, and of H2 to 98% converted, in about 50 h per charge of 40:30:30 syngas at 20 psig. The consumption of CO and H2 is correlated with mass transfer. Batch fermentation of syngas with Clostridium strain P11 with a high total pressure of rich syngas does not use the mass transfer capacity of the serum bottle fermentors efficiently, evidenced by low apparent kL,COa/VL. The fermentation becomes mass transfer limited as cells grow and CO and H2 are depleted. Under mass transfer limitation, gas is transferred at the maximum capacity of the fermentor, and substrate gas concentrations at the cell are near zero. Kinetic limitation is reestablished when nutrient limitation limits growth and energy demand for the cells. Practioners of fermentation mass transfer generally adhere to the theory that ?more is better.? However, in an industrial scale, more mass transfer is costly in capital and operating expense of over-designed equipment. Our study shows that inefficient mass transfer can be detrimental to activity of the fermenting culture and productivity of the fermentation. Application of appropriate mass transfer will optimize productivity in synthesis gas fermentation. Future study will further define ?appropriate? mass transfer.
The results showed that the three novel moderately alkaliphilic strains of Alkalibaculum bacchi CP11, CP13 and CP15 grew at initial pH between 7.7 and 8.0 and produced ethanol and acetic acid using Syngas I (20% CO, 15% CO2, 5% H2 and 60% N2) and Syngas II (40% CO, 30% CO2, and 30% H2) in bottle fermentations. However, strain CP15 is the most promising for ethanol production because of its higher growth and ethanol production rates and yield compared to CP11 and CP13. A maximum ethanol yield from CO of 76% was obtained with strain CP15 and syngas II after 360 h. CP15 produced over twofold more ethanol with Syngas I compared to strains CP11 and CP13. In addition, CP15 produced 18% and 71% more ethanol using Syngas II compared to strains CP11 and CP13, respectively.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes

Brief Explanation

A significant drought hit Oklahoma in 2011 and greatly impacted the harvesting and storage components of this study. The U.S. Drought Monitor for Oklahoma on July 26, 2011 is shown below.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

- Journal articles published - number and quality
- Proposals - submitted and awarded
- Seminar and poster presentations

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 17

1. Name of the Planned Program

Childhood Obesity - Human Nutrition and Health

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	70%		0%	
724	Healthy Lifestyle	30%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Actual Paid Professional	29.0	0.0	0.0	0.0
Actual Volunteer	12.2	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
475000	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
475000	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2400000	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Development of new curricula

• Adaptation & supplementation of existing curricula

• Outreach to families, schools, child care providers, direct assistance, demonstrations, and educational opportunities relating to food, healthy eating, exercise, diet, etc.

• Development of surveys, evaluation tool

• Searching out and applying for appropriate grants

• Delivery through classes, One-on-One, News Releases/TV/Radio, Participation in Events, Displays

•Provide training and other staff development opportunities to county educators

•Create public awareness of programs and resources through promotional and educational materials to be distributed to teachers, agency professionals, and other community members.

Accomplished through programs such as:
Healthy Oklahoma Youth
Farm to You
Food and Fun for Everyone
Fresh Start - Nutrition and You
Community Nutrition Education Program

2. Brief description of the target audience

Youth, children; parents; teachers; adult volunteers; middle to low income families; race and ethnicity will also be recognized as an identifier of audiences; caretakers, agencies & service providers, schools, policy makers.

3. How was eXtension used?

Worked closely with appropriate eXtension CoPs

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	123059	11300000	66300	5600000

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

Year: 2011
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	3	0	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Revised On-Line Curricula

Year	Actual
2011	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Number of youth improving food, nutrition, and/or physical activity behaviors through Healthy Oklahoma Youth Program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	16599

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over the past decade, the percentage of those overweight has steadily increased in Oklahoma. As many as one in five Oklahoma children are at-risk of overweight or overweight; and two-thirds of adults are overweight or obese. Among children and adolescents, overweight increases the risk of type 2 diabetes, high blood pressure, and cardiovascular disease. The health of Oklahoma youth can be improved by increasing knowledge, skills, attitudes and behaviors related to food and physical activity. Overweight, obesity and associated health problems have a significant economic impact. The estimated annual cost of overweight and obesity in the United States is $117 billion. Just a 10% sustained weight loss has been estimated to reduce an overweight person?s lifetime medical costs by $2,200 to $5,300.

What has been done
Nutrition Education for Youth
The OCES Healthy Oklahoma Impact Team (HOIT) educates Oklahoma youth on healthy food, nutrition and physical activity behaviors with the aim of reducing overweight and risk for related chronic disease. Efforts are conducted primarily in elementary classroom settings across the state using a six lesson series. Topics include increasing consumption of breakfast, using nutrition facts labels to make healthy snack choices, making healthy choices when eating out, making healthy beverage choices, increasing intake of dairy foods, fruits and vegetables, and increasing time participating in physical activity. Lessons are aligned with the Oklahoma Priority Academic Student Skills (PASS).

Steps to a Healthy Oklahoma.
To increase physical activity levels of Oklahoma youth the OCES HOIT has developed thirteen supplemental teacher lessons combining nutrition education and physical activity. Lessons are aligned with PASS.

Farm to You Exhibit
OCES programs targeting youth populations joined efforts with State agencies and agricultural commodity organizations to offer an interactive educational exhibit linking agriculture as the source of nutrient dense foods and role of these foods to health. The collaborating programs and agencies include OCES HOIT, OCES Community Nutrition Education Program (CNEP), OCES 4-H, OCES Ag in the Classroom, Oklahoma State Department of Health WIC Service, and Southwest Dairy Farmers. Exhibit messages are consistent with and enhance the HOIP and CNEP youth program messages, are research based and consistent with United States Department of Agriculture (USDA) Dietary Guidelines for Americans 2005 and MyPyramid.

Results
Since September 2008, the Farm to You exhibit was experienced by approximately 56,944 youth and 2,230 community volunteers in 56 counties. The average number of students reached per site visit over the 3 year period was 312 students and 12 community volunteers. In a case/controlled evaluation, the exhibit was found to enhance behavior change in students who were exposed to both classroom nutrition education lessons and the exhibit compared to those exposed solely to the classroom lessons. The project received national attention by being featured in Weighing the Options: How Can We Encourage Healthy Weights among America's Youth, a publication of the National Issues Forum Network, West Virginia Center for Civic Life. In 2010, it received the Dr. Rodney Huey Memorial Champion of Oklahoma Health Award.

The HOIT reached a total of 16,599 youth through school classroom nutrition education efforts. Important improvements in food, nutrition and physical activity behaviors were observed among participating Oklahoman youth which can have a role in reducing overweight and risk of related chronic diseases. The statistically significant observed improvements include:
33% increase in eating whole grain breads and cereals.
27% increase in eating fruits and vegetables.
27% increase in drinking milk or eating cheese or yogurt
32% increase in eating low-fat meats
33% increase in eating foods from 2 or 3 MyPyramid food groups for breakfast.
29% increase in snacking only when hungry.
39% increase in using nutrition facts labels to make food and beverage choices.
34% increase in eating small amounts of high fat foods.
34% increase in eating small amounts of sugar-sweetened beverages.
23% increase in time spent in physical activity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Food Insecurity and Hunger in Oklahoma - Community Nutrition Education Programs - Number of youth receiving nutrition information

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	23332

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Of households experiencing hunger, less than 20% are classified as unemployed. More than one-third are disabled and/or retired, while the remaining 40% have at least one working member.

Oklahoma loses an estimated $1.4 billion each year from hunger through illness, increased illness and decreased academic achievement alone.

Among seniors receiving food through Oklahoma?s Food Bank System, 45% report having to choose between buying food or paying for medicine or medical care.

In 2010, 24.5% of children under the age of 18 lived in poverty and 1 in 5 children were at risk for being hungry.

In 2010, over 616,000 Oklahomans lived in poverty. The prevalence of low socio-economic status is associated with poor nutrition habits that contribute to chronic disease including heart disease, cancer, stroke, and obesity.

During 2011, Supplemental Nutrition Program Assistance (SNAP, previously known as the Food Stamp Program) participation increased 9.2% over the previous year and doubled the amount distributed 5 years ago.

What has been done
Through the Community Nutrition Education Programs (CNEP), OCES has leveraged state monies to provide over $3.8 million (FY11) in federal nutrition education program funds. This funding supports 108 jobs in 49 Oklahoma counties. CNEP is a voluntary program for adults participating in federal food assistance programs as well as impoverished youth in qualifying

schools and communities. Program participants learn to feed their families in order to promote good health and to plan and budget their food dollars so their family will not go hungry at the end of the month.
Working through OCES county offices, teaching paraprofessionals known as Nutrition Education Assistants (NEAs) coach participants during weekly lessons to build skills that enable them to stretch their family food dollars, plan and prepare more nutritious meals and increase physical activity. The research-based lessons involve hands-on learning experiences and can take place in the participant?s home or in small group settings.

CNEP educates Oklahoma youth on healthy food choices, safe food practices and physical activity with the purpose of reducing overweight and obesity and the associated risk of related chronic disease.

Results
In FY11 CNEP has had a positive impact on the health and wellness of 4,785 low-income Oklahoma families. Almost 96% of adult graduates demonstrate a positive change towards a healthy diet. In addition, 39% of graduates less often ran out of food by the end of the month and 36% report that their children ate breakfast more often.

CNEP staff provided a total of 5,598 hours of nutrition information on healthy eating practices, food preparation and food safety to 23,332 qualifying Oklahoma youth during the 2011 fiscal year.

The majority of enrolled youth (19,556) were taught through school enrichment programs; while 3,776 children received their nutrition education through short term community based programs.

After participating in CNEP, approximately 12% of surveyed youth participants more often consumed low-cost, healthy foods and 9% increased their frequency of hand washing.

In FY11, CNEP and OCES leveraged state monies to bring $3.8 million in federal nutrition education program funds to the state. Based on a 2009 study, estimated potential health care savings associated with nutrition education programs similar to the CNEP were approximately $26 million due to increased prevention of nutrition-related chronic diseases and conditions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Economy
- Public Policy changes
- Government Regulations
- Other (Access to schools)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The HOIT reached a total of 16,599 youth through school classroom nutrition education efforts. Important improvements in food, nutrition and physical activity behaviors were observed among participating Oklahoman youth which can have a role in reducing overweight and risk of related chronic diseases. The statistically significant observed improvements include:

- 33% increase in eating whole grain breads and cereals.
- 27% increase in eating fruits and vegetables.
- 27% increase in drinking milk or eating cheese or yogurt
- 32% increase in eating low-fat meats
- 33% increase in eating foods from 2 or 3 MyPyramid food groups for breakfast.
- 29% increase in snacking only when hungry.
- 39% increase in using nutrition facts labels to make food and beverage choices.
- 34% increase in eating small amounts of high fat foods.
- 34% increase in eating small amounts of sugar-sweetened beverages.
- 23% increase in time spent in physical activity.

Key Items of Evaluation