2015 University of Arizona Combined Research and Extension Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 06/24/2016

I. Report Overview

1. Executive Summary

We continue to do more with less. Despite limited appropriated financial support, we continue to make a difference, and are working to better balance our program areas with support.

• Arizona Cooperative Extension engages with people through applied research and education to improve lives, families, communities, environment, and economies in Arizona and beyond. With offices in all 15 counties and on five tribal reservations, we bring knowledge to people every day to enhance their work and enrich their lives.

• The Arizona Agricultural Experiment Station stimulates learning through exploration and discovery to enhance agriculture, the environment, our natural resource base, family and youth well-being and the development of local communities. We accomplish this mission by the integration, dissemination, and application of knowledge in the agricultural and life sciences.

Research is conducted in the various departments and schools on campus, as well as at Agricultural Centers throughout the state. Research generated through the Experiment Station underlies and supports the academic and extension programs.

The College of Agriculture and Life Sciences has six programmatic focus areas:

- Environment, Water, Land, Energy and Natural Resources
- Plant Systems
- Human Nutrition, Health and Food Safety
- Family, Youth and Community
- Animal Systems
- Marketing, Trade and Economics

Environment, Water, Land, Energy and Natural Resources
Water Investigations Program

• Students showed an 81% increase in understanding where their water comes from. A nationwide poll, conducted by The Nature Conservancy and FMMM & Associates, revealed that only 23% of adults could identify the natural source of their water while 69% of WIP graduates can name a specific river that their water comes from.
• WIP students show a 27% gain in their understanding of how to audit a water faucet calculating annual usage. That raises awareness exponentially to help others understand the impacts of water conservations and usage.
• The project received positive press coverage throughout Maricopa County, Arizona's largest and most-populous county, in a March 2015 airing: http://www.fox10phoenix.com/news/1584153-story
• A 64% increase in knowledge is seen on the subject of saving water using technology.

Nutrient Fertigation Management for Southwestern Pecans
The cost of zinc fertigation is substantially lower than the conventional fertilization methods, saving growers between $150 and $270 per acre each year. Nearly all pecan orchards that have pressurized irrigation systems which are necessary for fertigation have adopted this practice. Currently, this is more than 25 percent of Arizona pecan acreage. The current savings to the industry is between $1 million to $1.6 million per year. This number is expected to continue growing as more acreage is planted and older orchards are converted from flood to pressurized irrigation.
In general, if trees receive adequate nutrition, water is used more efficiently. Additionally, improved nutrient management decreases the time from planting to first harvest, which is between 5 and 8 years for pecans. Shortening this time has a significant impact on grower investment returns.

Plant Systems
Incorporating Key Pest IPM into Horizontal Contexts of Multiple-Pest IPM

- Despite recent outbreaks of various pests, over $451-million has been in insecticide spray costs and crop yield savings.
- 7 of the last 10 years have been record lows in cotton insecticide costs, saving growers millions of dollars that are pumped back into the local economy.
- 2015 was the 6th-lowest in costs of foliar insecticides used in cotton in history.
- In 2015, we have returned to exceptionally low insecticide use in cotton, spraying just 1.9 times all season long, mainly with very strategically, selective compounds that are safe and beneficial.

Improving Desert Agricultural Production and Produce Safety
Increased Wheat Production Efficiency: In 2015, over 32,500 acres were planted to wheat in Yuma County, all following a winter vegetable crop. As an outcome of this program, 23 percent of Yuma area wheat producers have now incorporated a form of minimum tillage practices in their production schemes with significant savings on fuel, labor and time, with no apparent reduction in durum wheat yield or quality. No wheat producers were conducting minimum tillage practices in 2005.
Greater Lettuce Production Productivity: Field studies conducted during the 2008-2010 winter growing seasons to evaluate bed size, and three irrigation methods for romaine and iceberg lettuce resulted in enhanced production efficiency and water conservation. During the 2015 produce season, approximately 55 percent of romaine and 10 percent of iceberg lettuce was grown using the condensed growing strategies.
Greater Adoption of Advanced Agricultural Technologies: In 2005, only about 20,000 acres of agricultural production utilized advanced agricultural technologies in the Yuma area, and producers desired a greater understanding of on-farm GIS mapping and data conversion training. As an outcome of the program, producers now have greater proficiency in precision agriculture technologies resulting in a 5-fold increase in precision crop acres within the region since 2005.
USDA-Certification for Good Agriculture and Handling Practices: Arizona leafy green producers adopted a new collection of production standards, the Arizona Leafy Greens Shipper Marketing Agreement (AZLGMA), in spring 2008. The agreement is a 100 percent commitment among Arizona growers to produce leafy greens within a strict set of unprecedented compliance guidelines developed in collaboration with university and industry scientists, Yuma County Cooperative Extension, food safety experts, producers, processors and shippers. In Yuma County, 100 percent of fresh produce growers are AZLGMA compliant. In 2011, a series of USDA Good Ag and Handling Practices (GHP/GAP) workshops were initiated in Arizona. The food safety protocols include all fresh produce and not just leafy greens as outlined by the AZLGMA. As a result of the GHP/GAP workshops in Arizona, there has been a 7-fold increase in number of USDA-certified Arizona GHP/GAP growers.

Human Nutrition, Health and Food Safety
Healthy Lifestyles - SNAP-Ed and EFNEP

• We reached 4,856 unduplicated youth participants and 706 unduplicated adult participants. We also recorded 36,501 Interventions and 931,265 overall contacts.

• SNAP-Ed participants recorded the following behavior, skills and knowledge changes: Kindergarten students reciting the daily food servings needed to keep themselves healthy; elementary children reporting that they ask their moms to buy fruits and vegetables she has not purchased before; children singing 'Happy Birthday' in the restrooms while they wash their hands, etc.

• A student's mom came in to share with me about how their child insisted on only drinking 1% or Fat Free milk. She told me that her child would teach his younger siblings about eating healthier snacks.

• Modest evidence showed that milk type knowledge increased (12%, p=0.070). For behaviors, there was a significant decrease in whole milk consumption (-24%, p<0.05) and less robust evidence for an increase in 2% milk consumption (15%, p=0.076), which suggests a possible movement of some students from higher to lower fat milk.

Campylobacter Vaccine for Poultry Targets Human Foodborne Illness
Ongoing research trials show the vaccine significantly reduces the ability of Campylobacter to colonize young chickens. Risk assessment indicates that a 99 percent reduction of the Campylobacter load on chickens, such as that supplied by the vaccine in development at the UA, would reduce the incidence of campylobacteriosis associated with chicken meals by a factor of 30 (e.g., 2014 CDC reported incidence rate from Campylobacter infection of 13.45 per 100,000, if 50% percent were from chicken meals, the attributed 6.725 would be reduced to 0.23 per 100,000).

The vaccine's human health and economic impacts have the potential to be substantial, as the U.S. has the largest broiler chicken industry in the world, producing approximately 8.54 billion broiler chickens in 2014 (51.4 billion pounds), with a production value of $32.7 billion, according to USDA figures. Successful vaccination of chickens would lead to compliance with the new USDA performance standards for Campylobacter in chicken and by improving the safety of poultry meat, the number of human campylobacteriosis illnesses can be reduced.

Family, Youth & Community
Healthy Lifestyles: 4-H Science

• 418 market/carcass animals sold at the Pinal County Fair (392 exhibitors) for an estimated $855,000 in revenue - an 11% increase in year-over-year data.

• In 2015, there were increases in number of registered buyers (544) as well as number of 4-H members tagging market livestock (411) through the Fall.

• A 4-H demonstration garden was enhanced to show various planting mediums and inspire clientele to discover what works in their home environment. 4-H will utilize Common Measures-Science evaluation for gardening going forward.

• Pinal County now has 711 certified participants and 147 trainers (12% increase).

Developmental and Sensory Screening for Youth The goal of the developmental and sensory screening program is to increase the number of children from 0-5 who are screened and to improve access to early intervention for vision, hearing, and developmental issues for young children. Approximately 6,500 screenings were conducted through the program in 2013. In 2014, that number increased to 10,197 screenings completed on children 0-5 to detect developmental delays or vision/hearing problems, with 1,129 referrals made to medical homes. In 2015, there were 9,143 screenings completed on children 0-5, with 1,732 referrals made to medical homes as needed.

Animal Systems
Rangelands and Cattle Production

• Nearly 100 participants attended the offered livestock/rangeland meetings which helped increase awareness across the region.
• Ordinance 2-B (Hualapai grazing ordinance originally written in 1991) was revised and approved by Hualapai Tribal Council. This process began in 2013, as it was identified as the highest priority on a task list developed by ranchers during a series of meetings on the future of Hualapai ranching and the impacts to the local economy.
• Four livestock Districts donated nearly one million dollars of their NRCS Conservation Stewardship Fund monies to go towards education of the youth. This will be accomplished at the "Hualapai 4-H Youth Agricultural Facility", which began operations in 2015.

Integrated Livestock Management

• Evaluations from the AZ/SOUtah Range Livestock workshops indicated that 98% would benefit economically from knowledge gained,
• 95% indicated the programs were Superior/Excellent,
• 100% wanted programs to continue-
• 90% rated topics presented as Superior/Excellent.
• 95% of those attending of Reproductive update has provided them with a greater understanding of their cattle's reproductive problems and the knowledge to address solutions and understanding of programs to increase genetic outputs
• Evaluations indicated they really liked the hands-on demonstration and explanation. 12 producers that have attended last 4 years were individually evaluated on if they had recorded a change in their 1) Reproductive performance 2), cows bred and 3) calves raised. Results indicated a 6% increase (75% to 81% estimated an additional 24 calves per producer x12= 288 calves @$600.= $172,800. to that area and those producers).

Marketing, Trade and Economics
Improving Vegetable Production through Utilization of Spike Wheel Liquid Injection Technology

• We found that applied nitrogen rates could be reduced by at least 25% through use of point injection systems as compared to conventional means without negatively affecting crop yield.
• Reducing side-dressed nitrogen rates by 25% would save lettuce growers approximately $30/ac.
• In 2015 on-farm and research center trials, using of the point injection system with conservation tillage farming systems showed again that fertilizer rates could be reduced by 25% without negatively affecting yield in lettuce and by over 50% in broccoli.
• In one 2015 trial, cotton root rot disease incidence was reduced by over 70% as compared to the control and other application methods.
• In 2015, these results were disseminated to over 900 individuals via the multiple outreach means described. By demonstrating the device and conducting experiments on commercial farms at the field scale level, growers became much more familiar and accepting of the new technology.

Sustainable Economic Development: Solar Energy

• The update of Cochise County's Comprehensive Plan included a new policy to use the Renewable Energy Opportunity Analysis (REOA) in their deliberation over proposals for the installation of new utility-scale solar facilities in the county.
• REOA was used by planners in 2014 in their analysis and support of the Red Horse II solar facility west of Willcox. Approved by the county in April 2014, the project entails the installation of 250,000 solar panels over a section of land, and--as reported in the Arizona Range news (November 26, 2014)--will hire a total of 150 laborers/installers, electricians and heavy equipment operators.
• The data and maps from the Renewable Energy Opportunity Analysis (REOA) for southern and

central Arizona have been incorporated into city and county Geographic Information Systems (GIS) to provide planners and decision-makers with immediate access to maps showing areas of low, moderate or high opportunity for the construction of utility-scale solar facilities throughout their jurisdiction. In Pima County, regarding their use of the REOA results, a senior planner noted that, "We recently created a Solar Incentive District (REID) in Pima County, which identifies specific properties that are considered nearly 'shovel ready' for photovoltaic development and provides certain streamlined development processes. Your landscape-level analysis covering SE Arizona certainly corroborates our REID methodology and may inform our new Energy Element language as well." (Personal communication 2/2014)
The REOA website has been widely publicized through this agent's networks and newsletters. Google Analytics reports 3,747 individual users of the website for 2015. More specifically, in 2015, the data was used by:

- The director of Planning and Economic Development for the Hualapai Tribe to create a Reservation-wide solar opportunity map;
- The planning director for Graham County in his deliberations with the local utility company (Graham County Electric Co-op);
- An agricultural specialist with Sun Valley Solar Solutions;
- A private land developer in Cochise County interested in the potential of his property for siting solar facilities.
- In addition, the methodology was provided to a GIS specialist interested in creating a similar model for wind and solar farms in Australia.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	250.0	0.0	400.0	0.0
Actual	250.0	0.0	400.0	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

2. Brief Explanation

All new proposed Hatch projects are reviewed by an ad hoc review panel of 3 qualified faculty with no conflicts of interest. All renewal projects are reviewed by a panel of 2 similarly qualified faculty. The Associate Dean oversees this process and ensures that any suggested changes are made to the satisfaction of the reviewers and the Associate Dean. External review of programs and projects is obtained from County Extension Advisory Boards established under Arizona state law and from Agricultural Center Advisory Boards who meet on a regular basis.

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 traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals

Brief explanation.

A major rewrite of the College's Strategic Plan that covers the research, extension and academic programs of the College was completed in 2013. This effort involved review and comment by all faculty and staff, all advisory boards, major commodity organizations and selected stakeholders across the state. The major input was obtained from our advisory boards and meetings with major commodity organizations.

Our County Extension Director's Visioning Group is in the midst of sending out a broad reaching survey to audiences that may not know what Cooperative Extension is, or have only some small idea. The survey instrument was finalized, and we are currently collecting the data. It is part of the stakeholder input process and will help CE program directions in the future

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.

Over 100 county advisory board members provide input and priorities to county programs on an annual basis. Input for the research program is provided by advisory boards for our outlying Agricultural Centers. These groups plus numerous meetings with commodity organizations provide input annually for both Extension and Research programs

Our County Extension Director's Visioning Group is in the midst of sending out a broad reaching survey to audiences that may not know what Cooperative Extension is, or have only some small idea. The survey instrument was finalized, and we are currently collecting the data. It is part of the stakeholder input process and will help CE program directions in the future.

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)
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public

Brief explanation.

This is normally done by faculty meeting with the stakeholder groups throughout the year and providing them with written materials for their review and input. This may be expanded to a web-based survey available to all interested.

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

Brief explanation.

Input is requested from a variety of sources and considered when developing annual plans. We are currently in the process of reassessing all our programs.

Brief Explanation of what you learned from your Stakeholders

Stakeholders are very concerned about the federal debt, the national and world economy, and the lack of federal support and continued lack of state support for higher education.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
2030204	0	2535528	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	2019509	0	2557649	0
Actual Matching	2019509	0	2557649	0
Actual All Other	0	0	0	0
Total Actual Expended	4039018	0	5115298	0

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

MARKETING, TRADE, AND ECONOMICS

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
601	Economics of Agricultural Production and Farm Management	40%		40%	
605	Natural Resource and Environmental Economics	40%		40%	
608	Community Resource Planning and Development	10%		0%	
610	Domestic Policy Analysis	10%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	1.9	0.0	3.0	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**
219521	0	347507	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
219521	0	347507	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Improving Vegetable Production through Utilization of Spike Wheel Liquid Injection Technology
Issue
Arizona farmers have a difficult task to produce high-quality vegetables while maintaining costs. Add to that the importance of applying safe chemicals to the vast acres of crops without negatively impacting yields, and the work is that much more difficult. Recently, many issues of pesticides and insecticides have spurred public debate on the safety and importance of healthy regulations to what goes into farming soils. In short, farmers are in a constant battle to balance economic and environmental factors while continuing to produce the high-quality vegetables demanded to meet the needs of the ever-growing population. There are emerging technological advances to help with addressing the issues, but few growers utilize them because they are unaware of their existence or potential benefits.

What has been done
In this study, new fertilizer applicator technologies, such as the spike wheel liquid injection technology, was tested and used to inject fertilizer into the soil with minimal root damage and soil disturbance. Through the use of trials in 2012 and 2013, then backed up with additional field trials in 2014, the study showed some significant gains and impacts on crop productions and potential annual cost savings. In 2015, a project was initiated to evaluate the device for applying a cotton root rot fungicide. The goal of this project is to improve fungicide efficacy and identify viable methods for applying the product post emergence.

Sustainable Economic Development: Solar Energy
Issue
Residential construction and development is not driving Arizona's economy in the way it did in 2008. There is a glut of vacant housing, due to foreclosures, because of over entitlements granted in the mid-2000s. The future of economic development and community resiliency in Arizona will depend on a diverse economy that isn't reliant on just one sector such as housing or resource extraction--both vulnerable to boom-bust cycles. Enhancing local food systems and renewable energy are two areas that this program is assisting with to build more resilient communities that will be better prepared to weather future economic downturns.
What has been done?
Started in 2011, Renewable Energy Opportunity Analysis (REOA) was completed in 2013 to include all counties, cities and lands throughout the state. This analysis was conducted to provide decision-makers, solar developers and communities with maps and GIS shapefiles that identify the areas within their communities that are best suited for the siting of utility-scale solar facilities. The analysis used fundamental land use criteria such as the location of roads, transmission lines, substations, slope and aspect as weighted determinants of suitability. An agent with the UA College of Agriculture and Life Sciences Cooperative Extension and a professor from the UA College of Social and Behavioral Sciences supervised the GIS modeling process as well as the creation of the maps for each region of the state. The maps are accessible online. While the aim of this effort has been to publicize the availability of these maps and data as widely as possible, the maps have also been provided to cities, counties and individuals upon request, tailored to their specific area. Most notably, in November 2014 the results of the analysis were made available to anyone with an internet connection through an interactive online mapping application, and continued to be available through 2015: http://cals.arizona.edu/reoa/.

Impacts Reported in Overview Section

2. Brief description of the target audience

Commodity groups, state agencies, financial institutions, producers, marketing organizations

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2862	7500	12520	25000

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

Patent Applications Submitted

Year: 2015
Actual: 1

Patents listed
Algae Accordion Photo bioreactor

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	10	32	42

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Develop improved marketing and economic models
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Effectiveness of the research program will be based on publications, external grant support, and integration into existing extension programs.

Year	Actual
2015	81

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

Outcome #1

1. Outcome Measures

Increased financial stability of Arizona's producers

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of individuals gaining knowledge by participating in educational programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	15382

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
610	Domestic Policy Analysis

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

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

FAMILY, YOUTH, AND COMMUNITY

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
802	Human Development and Family Well-Being	20%		80%	
806	Youth Development	80%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	22.0	0.0	5.0	0.0
Actual Paid	5.6	0.0	0.8	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**
380475	0	101201	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
380475	0	101201	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Healthy Lifestyles: 4-H Science

Issue

America is facing a future of intense global competition. According to an article published in 2011 by the New York Times, 21% of all high school seniors across the country scored at or above the science proficiency level (NAEP, 2011). A mere 5% of current US college graduates earn science, engineering or technology degrees compared to 66% in Japan and 59% in China. According to the Arizona Department of Education (March, 2014), teachers are focusing on a Framework for K-12 Science Education vital to all Arizona youth, opening doors for 4-H in animal systems, school gardening and science-based programs. Pinal County 4-H science programs have been designed to meet the grassroots needs of its clientele. The over-arching goal for these educational programs are to teach solid science-based subject matter, threaded with life skills, and molded into an effective program which satisfies key developmental needs for all youth participants with long-term outcomes. Local program direction is determined in partnership with the Pinal County 4-H Advisory Council, Jr. Livestock/Quality Assurance, livestock industry direction, university specialists, Pinal County School Superintendents Office, Pinal County DIGS and National 4-H Council.

What has been done

Rigorous efforts were made to raise knowledge regarding Livestock Quality Assurance and Food Safety for area youth and adults, increase their skills, awareness and competence for raising quality, wholesome and safe food products. 200 youth participated in science-based food production systems including ethical and unethical productions practices and aerospace concepts.

Developmental and Sensory Screening for Youth

Issue

The 2014 Pinal Region Needs and Assets report, a needs assessment regarding early childhood in Pinal County conducted by First Things First with participation by Cooperative Extension and other community-based organizations, found that children under age 5 comprise approximately 8 percent of the population. The Pinal rates for development screening of children ages 0-3 lagged behind the state rates for 2009-2012. FTF has identified the need for vision, hearing, and developmental screening to begin earlier in life than when a child enters school; current research has confirmed the efficacy of using assessments to assess and intervene when delays are beginning as intervention early on holds the most promise for positive resolution.

What has been done?

Cooperative Extension in Pinal County screens children aged birth to five and a half years of age for vision, hearing and developmental impairments that could affect their developmental growth and diminish their quality of life and success in school. Early detection of problems through these free screenings leads to referrals for further evaluations, to determine if there is impairment. In addition, Cooperative Extension provides education for parents, child care providers and the general public regarding developmental and sensory stages in children so that they can receive services early in life when conditions may be corrected or improved.

Numerous partnerships have been developed with childcare centers and school districts with pre-K programs, offering sustainability in scheduling yearly screenings and tracking of success. UA Cooperative Extension has become partners for Child Find in Casa Grande, Maricopa, and Coolidge. It has conducted training for others on how to use the ASQ3 and ASQ/SE screening tools, including training for other agencies on proper administration and scoring so screenings across the county are valid and consistent. Long-term goals include using a countywide hub to keep screening data in one location.

Impacts Reported in Overview Section

2. Brief description of the target audience

Parents, educators, youth, community groups.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	34349	250000	112590	50000

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	46	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in educational programs

Year	Actual
2015	0

Output #2

Output Measure

- Number of educational events, training workshops and clinics

Year	Actual

2015	575

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Adoption of essential life skills by Arizona's youth that leads to a responsible, productive, and healthy life-style
2	Adoption of life building skills including self-discipline, responsibility and leadership

Outcome #1

1. Outcome Measures

Adoption of essential life skills by Arizona's youth that leads to a responsible, productive, and healthy life-style

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Adoption of life building skills including self-discipline, responsibility and leadership

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

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

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing

needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

HUMAN NUTRITION, HEALTH & FOOD SAFETY

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
702	Requirements and Function of Nutrients and Other Food Components	10%		40%	
703	Nutrition Education and Behavior	75%		20%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	15%		40%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	9.0	0.0	10.0	0.0
Actual Paid	2.6	0.0	1.5	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**
201749	0	160679	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
201749	0	160679	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Healthy Lifestyles - Teens Advocating for Sustainable Change Program
Issue
One of the biggest challenges facing our nation is the high prevalence of overweight and obese children, youth and adults. To improve the health of our nation, children and youth must move into adulthood without carrying the undue burden of obesity and its associated chronic diseases. According to the American Dietetic Association 2008, an investment of $10 per person per year in proven community-based programs to increase physical activity, and improve nutrition use could save the country more than $16 billion annually within 5 years. Due to the growing burden of chronic diseases related to the risk factors of overweight and obesity in the border population, the effects of a sedentary lifestyle and poor eating habits are critical in educating and preventing youth from a lifetime of these conditions. Obesity is related to serious health conditions such as hypertension, type-2 diabetes, hypercholesterolemia, coronary heart disease (CHD), stroke, asthma, and arthritis.
What has been done
Through programs like the Supplemental Nutrition Assistance Program (SNAP-Ed) and Extension Food and Nutrition Education Program (EFNEP), we have reached many people throughout the state to make them aware of various ways to increase their physical and mental health through nutrition and physical activity. When people attain knowledge regarding nutrition and physical activity, change, improve, maintain related behaviors, research shows that chronic disease risk (for diabetes, high blood pressure, & obesity) decreases. Policy and environmental changes at SNAP-Ed sites (eg mandatory lunch visits to salad bars in school cafeterias) contribute to the overall decrease of chronic disease in society.
Campylobacter Vaccine for Poultry Targets Human Foodborne Illness
Issue
Food safety remains a high level concern to the general public. Campylobacter is the second most common cause of human foodborne diarrheal illness in the United States, causing an estimated 1.3 million cases annually and resulting in health care costs of somewhere between $800 million and $5.6 billion per year. The handling and consumption of poultry is considered to be the most significant risk factor in transmission of the bacteria to humans, with up to 80% of human campylobacteriosis cases attributable to the poultry reservoir. Complications of infection with Campylobacter include Guillain-Barre syndrome, reactive arthritis, and irritable bowel syndrome. The U.S. has the largest broiler chicken industry in the world, producing approximately 8.54 billion broiler chickens in 2014. Chicken consumption surpasses both beef and pork consumption.

In 2011, the USDA Food Safety and Inspection Service (FSIS) implemented new performance standards for Campylobacter on chicken carcasses at processing establishments. These standards allow no more than eight positive Campylobacter samples in a 51-sample set. Furthermore, in January 2015, the agency identified new Campylobacter performance standards for raw chicken parts (breasts, legs, and wings) and ground chicken and turkey products. To date, there is no vaccine available to industry to reduce the numbers of Campylobacter in poultry and intervention strategies remain insufficient to achieve mandated levels.

What has been done?
Funded by the USDA, faculty and graduate students in the UA School of Animal and Comparative Biomedical Sciences, along with Dr. Roy Curtiss at University of Florida and Dr. Ken Roland at Arizona State University, have developed a new poultry vaccine using an attenuated strain of Salmonella to express Campylobacter genes for display to the poultry immune system. The vaccine reduces the number of Campylobacter organisms colonizing the chicken, in turn reducing Campylobacter on the surface of chicken meat and the amount transferred to humans, which may ultimately result in significantly fewer cases of foodborne illness due to Campylobacter . The vaccination process is simple, safe and can be integrated into existing poultry production systems. The Salmonella vaccine strain is engineered to live long enough to stimulate immune responses, is attenuated so it cannot produce disease in chicks or

humans, and dies before the chicks are harvested. The goal is to halt contamination before it spreads to raw chicken sold in stores. The researchers are working with the UA's Tech Launch Arizona to partner with industry and further develop the vaccine to meet the needs of poultry producers. Poultry vaccine studies are continuing in alignment with these goals, with a focus on the feasibility of the vaccine in the industry setting.

Impacts reported in Report Overview

2. Brief description of the target audience

General public, educators, health professionals, extension educators.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	210322	400000	131857	250000

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	56	103	159

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Effectiveness of the research program will be based on publications, external grant support, and

integration into existing extension programs

Year	Actual
2015	157

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Create awareness and increase knowledge
2	Number of individuals adopting recommendations for nutrition and health

Outcome #1

1. Outcome Measures

Create awareness and increase knowledge

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	342179

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All citizens need to be aware of importance of nutrition, health and food safety

What has been done
Workshops, health fairs, including EFNEP and SNAP-Ed programs.

Results
342,179 participants, not including indirect contacts were made aware and gained knowledge of these issues.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Number of individuals adopting recommendations for nutrition and health

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	342179

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

ENVIRONMENT, WATER, LAND AND NATURAL RESOURCES

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	35%		44%	
111	Conservation and Efficient Use of Water	30%		25%	
112	Watershed Protection and Management	15%		10%	
121	Management of Range Resources	20%		21%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	11.0	0.0	21.0	0.0
Actual Paid	9.7	0.0	802.0	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**
871014	0	826638	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
871014	0	826638	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Water Investigations Program
Issue
With growing populations and their impacts on natural resources within the state of Arizona, critical programming has been initiated to address the future needs of the citizens and water conservation. Awareness at a young age will help to shape behaviors in understanding impacts of water usage, and mis-usage. There are many opinions as to what the future of Arizona is, but we can still anticipate record growth and the demand for natural resources. In addition, we can expect that there are going to be jobs designed to address the needs of the growing population and the skills needed to fill those jobs is something we can begin to look at currently.
What has been done
There are many tactics to address the concerns, but the Water Investigations Program (WIP) uses Science, Technology, Engineering and Math (STEM) to get students engaged with practical reasoning and problem solving. This solves two distinct purposes: 1.) It creates vast awareness on water in Arizona and helps to open that dialogue at a young age, and 2.) It provides students an avenue to get connected in the fields of STEM to solve real-world problems. The WIP used various funding to introduce ways to teach including hands-on working with water audit kits, stream water quality testing kits, macro invertebrate sampling kits, stream-flow meter, groundwater flow models and riparian area presentations. Training of volunteers and coordinators over the summer and school year help to prepare for the growing interest in the program.

Nutrient Fertigation Management for Southwestern Pecans
Issue
Pecans are increasing in importance in Arizona, the rest of the desert Southwest and globally. Native to low pH soils in the lower Mississippi River valley, they are not well-adapted to alkaline soils typical of arid regions. Specifically, they require careful management of zinc, and conventional options are expensive and only partially effective. Requirements of nitrogen and phosphorus, the other most highly managed nutrients, are not well understood. These management parameters must be maximized for efficient production and use of land and water resources.
What has been done?
Researchers at the University of Arizona College of Agriculture and Life Sciences have studied zinc management methods that could provide alternatives to the industry standard of multiple foliar zinc applications. The team has shown that injection of chelated zinc (zinc EDTA) into irrigation systems (fertigation) is a cost-effective and highly efficacious alternative. Even in very alkaline soils, fertigation effectively supplies zinc to all parts of the tree, including roots, stems, leaves, and developing fruit, and results in accelerated photosynthesis rates, tree growth, and nut yields. These studies indicate that elevated kernel zinc levels are associated with increased levels of antioxidants, which have human health implications. Nitrogen and phosphorus studies are in early stages and have to date provided limited data. All studies in this project consist of long-term field experiments conducted in commercial grower orchards so growers have exposure to our studies and trust that results are applicable to commercial production systems. Results are disseminated via individual grower field visits, presentations at grower and professional meetings, and publications.

Impacts reported in Report Overview

2. Brief description of the target audience

Natural resource managers, Governor's Office and state agencies, municipal organizations and leaders, households, consumers, youth, master gardening and master watershed programs.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	45316	69000	12870	25000

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

Patent Applications Submitted

Year: 2015

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	148	190	338

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in educational programs

Year	Actual
2015	58186

Output #2

Output Measure

- Number of individuals adopting new technology

Year	Actual
2015	1500

Output #3

Output Measure

- Effectiveness of the research program will be used to reach direct and indirect contacts.

Year	Actual
2015	386

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Effectiveness of research programs will be based on publications, external grant support, and integration into existing extension programs
2	Number of individuals gaining knowledge by participating in educational programs
3	Volunteers completing Master Gardening training
4	Create awareness and increase knowledge

Outcome #1

1. Outcome Measures

Effectiveness of research programs will be based on publications, external grant support, and integration into existing extension programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All participants in the research and extension programs and the respective clientele for these programs care.

What has been done
Arizona has a fully integrated research and extension program and all faculty strongly pursue competitive grants.

Results
More than $1.5 million dollars in non-USDA grants were obtained to support this program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources

Outcome #2

1. Outcome Measures

Number of individuals gaining knowledge by participating in educational programs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	12808

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources

Outcome #3

1. Outcome Measures

Volunteers completing Master Gardening training

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	183

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Master Gardener program is an important component of our Cooperative Extension program.

What has been done
1,338 volunteers donated their time teaching others

Results
Master Gardener volunteers donated over 93,900 hours in 2014

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources

Outcome #4

1. Outcome Measures

Create awareness and increase knowledge

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All recipients of our programs care about increasing their knowledge.

What has been done
1,338 Master Gardener volunteers shared information directly with 22,909 program participants.

Results
The majority of the recipients consistently indicate a change in knowledge resulting from our programs and materials.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

PLANT SYSTEMS

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		30%	
205	Plant Management Systems	25%		15%	
206	Basic Plant Biology	25%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	20%		20%	
212	Diseases and Nematodes Affecting Plants	20%		15%	
215	Biological Control of Pests Affecting Plants	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	3.3	0.0	6.8	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**
289194	0	666163	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
289194	0	666163	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Incorporating Key Pest IPM into Horizontal Contexts of Multiple-Pest IPM
Issue
Pesticides are powerful tools for controlling pests within agriculture - both food and fiber. However, some pesticides pose a greater risk than others to human health and the environment. Today's farmers are under constant pressure to develop new ways to combat pests while keeping the yields safe and healthy. Recently, various insect and pest outbreaks have prompted further understanding and research of additional, more integrative, IPMs and their impact to field crops. The Brown Stink Bug posed special problems from 2012-2014, especially in identifying practices compatible with key pest IPM. Aflatoxin levels were at decade's high levels in 2013 and continue today. And Arizonans are always on the lookout for other outbreaks and ways to combat them.
What has been done
Through this program, faculty have put together material through research to make those within the agriculture community aware of Multiple-Pest IPM methods. Many people have been reached through publications, presentation, and workshops. Researchers have consulted on various publications and articles on the role of GM technology in our food system and delivered training on this topic to Master Gardener groups to help provide them with evidence-based information to share with others. In addition, a 20-year database has been made available for reference and a major effort was made to supply growers with key natural enemy information from 2011-2014. In 2015, six (6) additional grants were secured to provide funding for research and operations.

Improving Desert Agricultural Production and Produce Safety
Issue
Commercial agricultural production within western Arizona (Yuma County) is represented with approximately 120,000 multi-cropped acres (of 270,000 acres total) exceeding $2.8 billion in 2014 (Frisvold, 2014). Since 2005, the specific needs of agricultural producers in the region have been assessed on an annual basis at the conclusion of field day events, meetings, workshops and interactions with grower groups. In 2012, this countywide appraisal, in collaboration with the Arizona Department of Agriculture, resulted in a statewide Extension and outreach, research-based effort whose focus covers all field production and handling aspects of fresh produce safety.
What has been done?
The "Enhancing Desert Crop Production and Produce Safety" program identifies current problems and issues facing agricultural producers in the region, and develops new and appropriate technologies, tools and cropping schemes for greater crop uniformity, quality and production. It coordinates Extension efforts with departmental collaboration in the UA College of Agriculture and Life Sciences, state regulatory agencies and industry representatives to deliver information through various avenues to benefit Arizona producers. In 2015 the program disseminated university-, extension- and agent-developed curricula, publications and other information to more than 1,200 clients within the state via meetings/workshops and one-on-one contacts. By adopting innovative agricultural schemes and technologies into current management practices, growers will be better prepared for a future of changing agricultural landscapes with improved farm profitability and minimized adverse effects to the environment.

Impacts reported in Report Overview

2. Brief description of the target audience

Commodity groups, state agencies, pest management advisors, pesticide applicators, youth, ag-ventures programs.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6154	18000	3679	12000

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

Patent Applications Submitted

Year:	2015
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	46	125	171

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in educational programs

Year	Actual
2015	9833

Output #2

Output Measure

- Number of research projects conducted on all aspects of Plant Sciences, Animal Sciences, and Agriculture and Resource Economics
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Number of research projects conducted on all aspects of Plant Sciences, Entomology

Year	Actual
2015	254

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Adoption of better management practices for crop and animal production
2	Adoption of alternative crop and animal technologies
3	Adoption of more cost effective means for controlling plant and animal diseases along with insect issues
4	Adoption of more cost effective means for controlling plant diseases, including insect issues
5	Adoption of alternative crop technologies.

Outcome #1

1. **Outcome Measures**

Adoption of better management practices for crop and animal production

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Adoption of alternative crop and animal technologies

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Adoption of more cost effective means for controlling plant and animal diseases along with insect issues

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Adoption of more cost effective means for controlling plant diseases, including insect issues

2. **Associated Institution Types**

- 1862 Extension
- 1862 Research

3a. **Outcome Type:**

Change in Knowledge Outcome Measure

3b. **Quantitative Outcome**

Year	Actual
2015	0

3c. **Qualitative Outcome or Impact Statement**

Issue (Who cares and Why)
New pests and diseases are appearing each year as they become more resistant to pesticides. Major insect damage to crops costing significant dollars and utilizing major amounts of pesticides.

What has been done
An integrated pest management program (IPM) established in Arizona in 1996, refined in 2006 and continued through today uses insect growth regulators (IGRs) effective against whiteflies, transgenic cotton (with Bt (Bacillus thuringiensis) effective against pink bollworms, and a reduced-risk feeding inhibitor (effective against Lygus bugs.)

Results
Statewide averages for cotton insecticide use patterns in Arizona from 1979 through 2010 show that insecticide use on cotton for all insects combined?including whiteflies, pink bollworm, Lygus bug and others reached a 32-year low over the last 5 years, while also reducing costs to all-time lows. The estimated cumulative savings in control costs and yield (from reduced losses to insects) from 1996 through 2010 was more than $223 million.
Growers applied 4.15 pounds of active insecticide ingredient per acre of cotton in 1995. In 2009 and also in 2010 the amount of active ingredient applied per acre was reduced by 3.66 pounds, or 88.3 percent, to just 0.48 pounds per acre. This is the equivalent of applying less than a can of soda on an area the size of a football field just once over the cotton season (March to October).

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants

Outcome #5

1. Outcome Measures

Adoption of alternative crop technologies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Control of Pink Bollworm in cotton plants

What has been done
Adoption of BT Cotton

Results
More than 95% of cotton farmers in AZ have adopted BT cotton. This resulted from the availability of the genetic material and demonstration by the UA that this technology is effective and economical.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
211	Insects, Mites, and Other Arthropods Affecting Plants
215	Biological Control of Pests 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

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

ANIMAL SYSTEMS

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
301	Reproductive Performance of Animals	30%		15%	
302	Nutrient Utilization in Animals	20%		15%	
305	Animal Physiological Processes	15%		20%	
306	Environmental Stress in Animals	15%		30%	
311	Animal Diseases	20%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Paid	0.6	0.0	3.5	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**
57556	0	455461	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
57556	0	455461	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Animal Foraging Behavior and Distribution
Issue
The Hualapai reservation is 992,463 acres in size with approximately 782,449 acres of useable rangeland. Range livestock production was encouraged for economic development after the establishment of the reservation in 1883, and it remains a significant part of the local economy for tribal members today. There are five grazing districts on the reservation. Prior to the Hualapai becoming cattle ranchers, cattle had been grazed on the reservation land by non-tribal neighbors. Over the past century, many different management practices were experimented with, and the numbers of animal units on the range has varied tremendously. Overgrazing, invasive weeds, erosion, wildfires, extended drought and an increase in non-native feral horses and burros and in elk populations have contributed to a deterioration of rangeland conditions.
What has been done
Trichomoniasis in the Neighborhood meeting helped increase awareness of this cattle venereal disease which had 34 attendees. "Hopi Cattle Program " presentation by Pat Browning of Hopi Ranches, David Bergman, APHIS Director in AZ "Prairie Dogs and Control Methods" and Harriet Mann from Farm Services Agency discussed "Youth Farm Loans" attracted additional members of the local and tribal community. We also co-sponsored an annual Livestock Association Meeting with Hualapai Department of Natural Resources which was well attended.

Integrated Livestock Management
Issue
With farmers struggling with costs of production, resources are needed now more than ever. They are dealing with many issues with livestock health and production and the Integrated Livestock Management program has been instrumental to deliver those resources of science-based research. The program's focus is to provide education and direction to animal producers and the public working and implementing grazing plans throughout Arizona as well as multi-state efforts.
What has been done?
Planned and conducted 2 county workshops, 3 regional programs and was on planning team that conducted 1 statewide effort. Planning team for Range Beef Nutrition workshop planned a multi-state Beef Cattle Reproduction workshop as well as the 33rd Annual Arizona-Utah Range Livestock Workshops to bring the most current information on livestock management issues to the producers, which drew nearly 400 people.

Impacts reported in Report Overview

2. Brief description of the target audience

Commodity groups, state agencies, pest management advisors, pesticide applicators, youth, ag ventures program. Plans are underway to attempt to include non-traditional audiences.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2015	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	500	3000	94	1500

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

Patent Applications Submitted

Year:	2015
Actual:	1

Patents listed
Targeted Biocides

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	3	62	65

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Effectiveness of the research program will be based on publications, external grant support, and integration into existing extension programs.

Year	Actual
2015	24

Output #2

Output Measure

- Number of individuals gaining knowledge by participating in educational programs, such as range livestock nutrition workshops.

Year	Actual
2015	594

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers adopting more sustainable and profitable large scale dairy production practices.
2	Adoption of more profitable breeds of cattle for arid land conditions

Outcome #1

1. Outcome Measures

Number of farmers adopting more sustainable and profitable large scale dairy production practices.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	180

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
306	Environmental Stress in Animals
311	Animal Diseases

Outcome #2

1. Outcome Measures

Adoption of more profitable breeds of cattle for arid land conditions

Not Reporting on this Outcome Measure

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

All programs are currently in the process of being evaluated externally for existing areas to preserve, protect, or enhance, as well as areas to discontinue or modify. We will continue to seek further input from stakeholders, advisory committees, and focus groups utilizing needs assessments with the assistance and expertise of an Evaluation Specialist [hire pending]. See State Defined Outcomes.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Childhood Obesity

☐ Reporting on this Program

Reason for not reporting

We do not have the resources to sustain this as a separate program. The information is included in the Human Nutrition, Health & Food Safety program.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	2.0	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Conduct workshops, research, meetings, school enrichment, and information delivery.

2. Brief description of the target audience

Special focus on youth/adult interaction.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	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: 2015

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	6	4	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- School districts, youth, and adults will address obesity issues

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Reduce childhood obesity

Outcome #1

1. Outcome Measures

Reduce childhood obesity

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Government Regulations
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Global Food Security and Hunger

☐ Reporting on this Program

Reason for not reporting

The efforts in programming and data in this area have been absorbed into various other programs and offerings already reported.

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2015	Extension		Research	
	1862	1890	1862	1890
Plan	11.0	0.0	44.0	0.0
Actual Paid	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
Actual Volunteer	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 Matching	1890 Matching	1862 Matching	1890 Matching
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}
1862 All Other	1890 All Other	1862 All Other	1890 All Other
{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}	{NO DATA ENTERED}

V(D). Planned Program (Activity)

1. Brief description of the Activity

Effectiveness of the research program will be based on publications, external grant support and integration into extension programs.

2. Brief description of the target audience

Commodity groups, state agencies, pest management advisors, pesticide applicators, youth, ag-ventures programs.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2015	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: 2015

Actual: {No Data Entered}

Patents listed

{No Data Entered}

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2015	Extension	Research	Total
Actual	20	110	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of individuals participating in educational programs

Year	Actual
2015	0

Output #2

Output Measure

- Number of research projects conducted on all aspects of Plant Sciences, Animal Sciences, and Agriculture and Resource Economics

Year	Actual
2015	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Adoption of better management practices for crop and animal production
2	Adoption of alternative crop and animal technologies
3	Adoption of more cost effective means for controlling plant and animal diseases along with insect issues

Outcome #1

1. Outcome Measures

Adoption of better management practices for crop and animal production

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #2

1. Outcome Measures

Adoption of alternative crop and animal technologies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

Outcome #3

1. Outcome Measures

Adoption of more cost effective means for controlling plant and animal diseases along with insect issues

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2015	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
{No Data}	null

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

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
0	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
0	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
0	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
0	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.