V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

MARKETING, TRADE & 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: 2014	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. The results were disseminated to over 300 individuals through use of publications, presentations, guest lectures, press, and field demonstrations to address issues of new knowledge and awareness.
Geothermal Cooling For Cows to Increase Milk Production
Issue
Heat stress in dairy cows during the warmest months causes decreases in milk yield, increases in disease incidence and also increases in maintenance costs per cow. Research has shown that compared to winter months, dairy cows in Arizona produced 8.8 pounds less milk per cow per day during the summer months. At the same time, on-farm milk production has the greatest opportunity to affect the carbon footprint of a gallon of milk because dairy operations represent 80 to 95 percent of the dairy industry's carbon footprint, and 75 percent of its electricity and fuel use. Cooling systems utilized in the dairy industry to alleviate the negative effects of heat stress have been shown to be efficient but require considerable resources (water and electricity). The scarcity of these resources and the cost of running these cooling systems have created the need to look for more efficient alternatives and the optimization of the current cooling systems. Geothermal cooling using chilled ground water is a viable alternative for cooling dairy cows, but the effectiveness of this form of conductive cooling is not well understood.
What has been done?
A previous study carried out at the University of Arizona in the School of Animal and Comparative Biomedical Systems evaluated geothermal conductive coolers using heat exchangers buried 25 cm beneath the surface of the bedding material. Cooled water is circulated through the heat exchangers to remove heat from dairy cows. This study was followed with another to investigate effectiveness of a geothermal conductive cooler when the bedding material was reduced to 12.7 cm. In this experiment, sand and dried manure were utilized as bedding material and heat exchangers for both were buried at 12.5 cm below the surface. Reducing the amount of bedding material above the heat exchangers increased the effectiveness of the coolers and was demonstrated to be the most effective bedding material for reducing body temperature of conductively cooled dairy cows. The utilization of heat exchangers at 12.7 cm effectively reduced the temperature of both bed materials from the top of the heat exchanger to the surface of the beds. Results of heat flux sensors located in the different beds indicated that heat flow from cows to the bedding material was greatest for sand in hot dry, thermo-neutral and hot humid environments (28.11, 26.07 and 31.86 W/m2 respectively, $P < 0.05$).
Overall results of this study corroborated results of the first study that sand is the best bedding material for conductively cooled beds for dairy cows and that reducing the depth of the bedding material increased the heat flow from the cow to the bedding material. This further supports the utilization of cooled beds as a

cooling approach for dairy cows exposed to thermal stress.

Impacts reported in Report Overview

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

2014	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: 2014

Actual: 1

Patents listed

Algae Accordion Photobioreactor

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	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
2014	81

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased financial stability of Arizona's producers
2	Number of individuals gaining knowledge by participating in educational programs.

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
2014	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
- 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