

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

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			13%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			62%	
502	New and Improved Food Products			15%	
504	Home and Commercial Food Service			5%	
701	Nutrient Composition of Food			5%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	3.0	0.0
Actual Paid Professional	0.0	0.0	2.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	150822	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	71857	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

Engineering Plants for Increased Nutrition and Improved Stress Tolerance

Over the past year, progress has been made in seed specific gene expression constructs to express the three thiamin (vitamin B1) biosynthetic genes in plants. These genes include the Arabidopsis thiazole synthase (an important enzyme in B1 production), the Arabidopsis hydroxymethylpyrimidine synthase (a catalysis in production of B1) and the Arabidopsis thiamine-monophosphate pyrophosphorylase (another enzyme catalysis). The three, seed specific, gene cassettes were inserted into a single plant transformation vector and inserted into Arabidopsis. The team is now screening the transgenic line generated in these studies.

Improving the Reproductive Anatomy of Plants Under Heat, Cold and Drought Stress

Scientists at UNR have made significant progress in all three areas of stress. This past year, the team found a "stress protection gene" that when over expressed increases pollen fertility under stressful conditions. Additional transgenic plants are now being tested to verify results. A second line of research, which addresses rewiring the plant's cell response to drought, was completed by bio-engineering a signaling pathway mutation that controls cell responses. Gene expression between wild type pollen and transgenic pollen when placed under heat stress was also explored. Our scientists have completed both wild and transgenic RNA sequence analysis to identify changes that correlate with improved heat stress tolerance. The team is now working to insert this mutation into transgenic plants.

Evaluation of Wine Grape Cultivars and Clones

In order to better understand the dehydration response at the transcript, proteomic, and metabolite level, using a dehydration assay (also developed over the past year) to test the hypothesis that source and sink tissues respond differently to dehydration. Another approach that was tested to better understand the response to dehydration of Cabernet Sauvignon leaves was using a shotgun proteomics with collaborators in Sydney, Australia. A final transcriptomics approach is now being investigated to determine the differences between two North American root stocks known to be drought tolerant.

Hydroponics impact on Content of Bioactive Compounds

Stage one has been completed with the retrofitting of two UN R greenhouses to accommodate hydroponically-based growing systems. Evaluations are finished on four different types of systems. Trials are now underway on the production quality of vegetables grown under new LED technology vs. standard metal halide lights. Trials have also begun on hydroponically grown berries' fruit quality.

2. Brief description of the target audience

The scientific community, agriculture producers, local organizations, backyard hobbyists, as well as students taking classes or participating in research activities.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	595	0	0	0

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

Patent Applications Submitted

Year: 2013

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	13	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Peer reviewed journal articles, publications in commodity group publications, presentations at scientific meetings, presentations at stakeholder, Native American and agency meetings
Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Demonstrations and Field Days Conducted
Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Newsletters Produced

Year	Actual
2013	3

Output #4

Output Measure

- Leveraged Research Projects

Year	Actual
2013	170800

Output #5

Output Measure

- Web Sites Created or Updated

Year	Actual
2013	3

Output #6

Output Measure

- Digital Media Created or Updated

Year	Actual
2013	13

Output #7

Output Measure

- Manuals and Other Printed Instructional Materials Produced

Year	Actual
2013	2

Output #8

Output Measure

- Number of Graduate Students or Post-Doctorates Trained

Year	Actual
2013	6

Output #9

Output Measure

- Number of Undergraduate Students Involved in Research

Year	Actual
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2013 19

Output #10

Output Measure

- Abstracts, Books, Book Chapter(s), Proceedings, Research Reports, and Technical Publications

Year	Actual
2013	2

Output #11

Output Measure

- Demonstrations, Field Days, and Workshops Conducted

Year	Actual
2013	28

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Peer reviewed journal articles, presentations at scientific meetings, presentations at stakeholder, Native American and agency meetings.
2	Improving Stress Tolerance in Wine Grape Cultivars for Northern Nevada
3	Urban Hydroponic Fruit And Vegetable Production: Impact On Content Of Bioactive Compounds

Outcome #1

1. Outcome Measures

Peer reviewed journal articles, presentations at scientific meetings, presentations at stakeholder, Native American and agency meetings.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Improving Stress Tolerance in Wine Grape Cultivars for Northern Nevada

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Grape production is one of the most important agricultural commodities in the USA and is threatened by global warming. This is particularly relevant in a semi-arid state such as Nevada with a rapidly growing population competing for scarce water resources. There is an emerging grape and wine industry in Nevada which has the potential for a very large economic impact on the state and the local grower. This project addresses which wine-grape cultivars are most water use efficient and seeks to select genotypes varying in enzymes, hormones and proteins production that can be used to improve water use efficiency and drought resistance.

What has been done

Over the past year, a rapid dehydration assay, developed at UNR, was used to investigate the rapid dehydration response of different Vitis cultivars. In order to better understand the dehydration response at the transcript, proteomic, and metabolite level, the above mentioned dehydration assay was used to test the hypothesis that source and sink tissues respond differently to dehydration. Another important player in drought signaling, the plant hormone abscisic acid, was shown to have differences in ABA metabolism between tissue types. Another approach that has been taken to better understand the response to dehydration of Cabernet Sauvignon leaves has been shotgun proteomics resulting in over 50 proteins showing significant

changes in abundance. Finally, a transcriptomic approach was taken to investigate differences between the two North American rootstocks (Ramsey and Riparia Gloire) to better understand their drought tolerances.

Results

To our knowledge this is the first observation of the plant hormone abscisic acid regulation in grape vine. This information will better our understanding of the complex interactions that are occurring between these two tissue types under conditions of rapid dehydration. Proteomic results are another significant addition to the scientific knowledge base, in that the abundance of over 50 proteins are changing very rapidly, some changes occurring within an hour of treatment.

Again this year, a tripartite program has provided training to the general public on how to grow grapes in Northern Nevada, how to make wine, and a wine tasting class held throughout the year. As a result, a 501 c3 was established "Nevada Vines and Wines" dedicated to improving Northern Nevada's wine industry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

Outcome #3

1. Outcome Measures

Urban Hydroponic Fruit And Vegetable Production: Impact On Content Of Bioactive Compounds

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Providing sources of high quality and safe fruits and vegetables for Nevadans, especially children, the elderly and vulnerable high-risk populations is a lofty goal. Nevadans, for the most part, live in arid rural and urban areas with short growing seasons, which limit the region's capacity to produce fruits and vegetables. Local communities and individuals are moving toward using a variety of alternative farming techniques, such as hydroponics, aquaponics, and hoop houses to grow fresh fruits and vegetables. However, there is scant research dealing with the impact of such

farming techniques on the quality and safety of fruits and vegetables.

What has been done

The investigative team from UNR analyzed four varieties of lettuce (Waldmann's Dark Green, Red Lollo Antago, Red Romaine Annapolis, and Butterleaf) to determine the concentration levels of two antioxidant compounds, vitamin C (ascorbic acid) and vitamin E (tocopherol), grown in soil verses hydroponically.

Results

Results indicate that hydroponically grown lettuce varieties are significantly higher in both vitamin C & E content than their soil-grown counterparts, and hydroponic gardening is a viable option for producing nutritious fruits and vegetables. The team has concluded that utilizing a hydroponic method of crop farming is sufficient for producing nutritious produce.

By working in close association with graduate students and various outside interests, the UNR team has given the green light for acceptable nutritional content levels of hydroponically grown lettuce. The project allowed a graduate student to complete a Master Degree in nutritional science. The project also trained undergraduate students on how to work on field projects and to otherwise assist with project implementation, data input, sample measurement, etc.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
701	Nutrient Composition of Food

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The Experiment Station is still trying to recover from the 31 hard money positions lost after the 2010 circulation review. Until a number of critical areas are re-staffed the agricultural program will be severely diminished. The circular review has also produced a number of administrative issues that contribute to the outcomes of our Ag program: the potential merger with Cooperative Extension, and all faculty changing from 12 month to 9 month appointments.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Nevada's research projects have an evaluative element that is required by state and federal-level funding sources that provides documentation related to project assumptions, goals and outcomes. This information is used to determine the overall success of research initiatives; their contribution to providing practical, real-world solutions and resources to address challenges and problems; and whether continuation funding and/or new dollars are appropriate and necessary as funds are available.

- Conducted over 24 workshops on cultivating, pest management and wine production
- Attracted the attention of hundreds of backyard-amateur viticulturists
- Trained 25 students and post-doc
- Leveraged over \$170,000 in extramural funds
- Created a community that wants to grow and promote the wine industry in Northern Nevada

Key Items of Evaluation

Created a community that wants to grow and promote the wine industry in Northern Nevada.