

**V(A). Planned Program (Summary)**

**Program # 3**

**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
121	Management of Range Resources			5%	
202	Plant Genetic Resources			5%	
204	Plant Product Quality and Utility (Preharvest)			5%	
205	Plant Management Systems			5%	
211	Insects, Mites, and Other Arthropods Affecting Plants			8%	
216	Integrated Pest Management Systems			5%	
301	Reproductive Performance of Animals			5%	
302	Nutrient Utilization in Animals			10%	
307	Animal Management Systems			10%	
311	Animal Diseases			30%	
502	New and Improved Food Products			10%	
903	Communication, Education, and Information Delivery			2%	
	<b>Total</b>			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	35.0	0.0
Actual Paid Professional	0.0	0.0	4.4	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	490514	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	4378479	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	2896871	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

Organic, value-added, and technological (bio-based, information-centered, robotic, nanotechnology, etc.) approaches complement conventional agriculture. By utilizing contemporary research tools in agronomy, animal or soil science, plant nutrition and pest management this program will develop improved practices for cropping and animal production systems that will enhance the potential use of alternative crops, reduce soil erosion, reduce the economic, social, and environmental costs of crop pests, and maintain or increase soil biological, chemical and physical properties. Animal systems will reduce wastes and discharges while improving productivity and husbandry techniques.

Research and extension will also look at key areas of various social changes in the marketplace impacting producers, retailers and consumers. The research aims to determine (1) how technology impacts producers/retailers/consumers in the market place, with a special emphasis on rural markets in America; (2) how society impacts consumer demand for goods and services with a goal of improving the well-being of consumers; and (3) how to develop economic linkages among producers, retailers, and consumers for the community development.

- Conduct Research Experiments.
- Conduct surveys
- Conduct Workshops, Meetings.
- Deliver Services.
- Develop Products, Curriculum, Resources.
- Provide Training.
- Provide Demonstrations
- Provide Counseling.
- Assessments.
- Work with Media.
- Partnering.
- Facilitating.

**2. Brief description of the target audience**

- Professional peers and scientific communities, extension faculty, veterinarians, vaccine producers
- State commodity commissions, grower groups, packers, crop consultants

- Natural resource industry clientele - growers, field representatives, grower co-ops and

partnerships, processors and handlers, export companies, importing companies

- County, state and federal agencies - USDA-ARS, Oregon Department of Agriculture, Natural Resources Conservation Service, Bureau of Indian Affairs, Confederated Tribes of the Umatilla Indian Reservation, US Forest Service, and Bureau of Land Management.

- Policy makers, public health officials, and community leaders
- Teachers and students, Extension personnel and other educators
- Genetic companies
- Nutritional consultants
- Nonprofit conservation groups and ecologists
- General public and consumers

### 3. How was eXtension used?

eXtension will be used to disseminate modeling results and findings to producers, decisionmakers and NGOs and as part of the educational role of faculty and extension personnel.

#### V(E). Planned Program (Outputs)

##### 1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	110	500	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
<b>Actual</b>	4	14	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- BASIC PHYSIOLOGY OF PLANTS AND ANIMALS...1- Environmental response by plants, 2 - Animal reproductive factors

<b>Year</b>	<b>Actual</b>
2013	0

**Output #2**

**Output Measure**

- DECIPHER GENOMES, GENETICS AND MECHANISMS...1- Niches and functions served by Bacteria And Viruses And Other Microorganisms, 2 - Genetic diversity, pathways and function, 3 - Genes and Mechanisms in disease resistance and tolerances, 4 - Reproductive factors in plants and animals

<b>Year</b>	<b>Actual</b>
2013	0

**Output #3**

**Output Measure**

- BREEDING PROGRAMS THAT RESULT IN DESIRABLE TRAITS, CULTIVARS AND VARIETIES...Indicator - improved traits, germplasm, and varieties.

<b>Year</b>	<b>Actual</b>
2013	0

**Output #4**

**Output Measure**

- IMPROVED ANIMAL AND PLANT PRODUCTION SYSTEMS...1 - improved animal reproductive success rates, 2 - animal nutrition, feeding and forage relationships, 3 - inputs for plant systems in dryland and irrigated production and on small farms

<b>Year</b>	<b>Actual</b>
2013	0

**Output #5**

**Output Measure**

- PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS...1 - pest management systems and strategies, 2 - disease resistance, 3 - herbicide identification and resistance

<b>Year</b>	<b>Actual</b>
2013	0

**Output #6**

**Output Measure**

- ENVIRONMENTAL HEALTH AND ECOLOGY...1 - erosion control, 2 - animal effects, 3 - green management practices

<b>Year</b>	<b>Actual</b>
2013	0

**Output #7**

**Output Measure**

- ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS...1 - land use management analyses, 2 - profitability and productivity studies

<b>Year</b>	<b>Actual</b>
2013	0

**Output #8**

**Output Measure**

- VOLUNTEER PROGRAMS o Reach Master Gardeners (new, past, and current) through MG training programs and materials, websites, and other distance education programs o Refine OSU Urban and Community Horticulture Website to reach new audiences.

<b>Year</b>	<b>Actual</b>
2013	0

**Output #9**

**Output Measure**

- DISTANCE and OTHER EDUCATION OUTLETS o Develop new databases and frequently most asked questions for eXtension o Compare perceptions of science teachers and agriculture teachers on integrating science into the agriculture curriculum

<b>Year</b>	<b>Actual</b>
2013	0

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	1a. improved plant production management systems, including precision systems, cultural practices, conservation strategies, innovations, pest control, and organic systems
2	2a - improved animal reproductive biology and management for better fertility and reduced uterine infections in dairy and beef cattle and sheep; as well as better understanding of reproductive genetics and developmental biology
3	2b - expanded forage and nutrient management knowledge to understand how management practices can synchronize the relationship between forage nutrient supply and cow nutrient requirements, and how feedstuffs can influence the health and physiological stress of the calf.
4	4a - plant breeding for improved or novel plant attributes and for human health benefits, e.g., antioxidants
5	5a - develop optimum pest management by identifying factors affecting herbicide activity, registering herbicides, controlling weeds in organic and no-till production; learning basic pest biology, registering new pesticides, finding application rates, and identifying risks associated with a pest as it becomes established
6	6a - economic studies help Producer groups learn about factors shaping global markets and productivity-convergence effects on US agricultural and processed food production and trade
7	A4 - Adoption of new varieties will reduce yield losses and expenses, rejuvenate orchards, achieve better productivity and efficiency, provide environmental benefits (less fungicide applications, etc.), allow effective competitiveness on the world market o Commercial processors and fresh market growers, as well as home gardeners, achieve greater production efficiency, more stable productivity, and reduced costs from the use of improved varieties.
8	2c - improved animal fertility and genetic stock, for example: o Producers and animal health professionals improve fertility and prevent uterine infections in dairy cattle from implementing every-day on-farm practices. o Industry stores sperm cells with minimal loss of function for use as a commodity and for long-term maintenance of genetic stock
9	A3 - Animal producers improve their economic competitive advantage and improve the ecological sustainability of production system
10	A1 - Conservation strategies adopted o Conservation bio-control strategies are implemented differently and active restoration strategies occur. Land owners and managers assess ecosystem services provided by their riparian restorations via a user-friendly web tool. o Growers adopt improved, scale-dependent practices selected for various market niches with emphasis on reducing environmental degradation and impact. Commercial small farms will have more diverse and economically viable technologies and production techniques or systems available for their use o Growers implement drip irrigation and produce more marketable yields of onions, potatoes, and poplar trees than with furrow or sprinkler irrigation. and achieve efficient use of soil nitrate and the other available N sources under drip irrigation. o Generation of the viral vectors for grapevine disease control and functional genomics vectors have a potential for replacing current strategies of using chemical fungicides and bactericides with viral biocontrol strategies.
11	A6a - Improved agricultural economies o The knowledge generated about productivity-convergence will be crucial in designing policies to improve the welfare of agricultural producers and food processors and the general public who will be affected by the evolution

	<p>of these industries (e.g., food quality and safety, resource scarcity and pollution). o Domestic policymaking and multilateral trade negotiations will mitigate effects of climate change in reduction of trade barriers and subsidies. o Climate change will be related to changes in comparative advantage in international crop production, and in turn the pattern and volume of trade. This information will be important in the context of domestic policymaking and multilateral trade negotiations as it pertains to reduction of trade barriers and subsidies.</p>
12	<p>Change Indicator 1 - Ecological / Environmental o Landscapes will impact the way Oregonians use and manage plants to create beauty, modify environment, and improve health and well-being of individuals and communities. This program will change the way people use plants to modify their environment such as moderating temperature on buildings, improving water infiltration on surfaces, contributing to ecosystem services at landscape or watershed scales, etc. o Food/farm systems reduce surface and/or groundwater or other pollution in the environment, while improving nutrient and water budgets, and organic production systems. o New reduced risk, environmentally safer pest control tools will be available that are target pest specific will facilitate the implementation of IPM programs. o Environmental change will occur from temperature modifications; enhanced water conservation and wildlife; reduced runoff, fire incidence and pests; improved nutrient use and recycling; and other ecosystem services. o Better ecological methodologies will lead to more social, economic, and environmental benefits and cost effective and sustainable restoration. Improved valuation of ecological services associated with restorations will greatly facilitate market-based conservation practices such as mitigation banking and effluent trading. Better conservation bio-control strategies will decrease the costs associated with insect losses and the use of insecticides. o enhance the nation's natural resource base and environment by revealing cost-effective means to control plant diseases and reduce the need for pesticides. o Biocontrols will reduce environmental damage and costs of grape growing and facilitate the development of the table and wine grapes with improved quality and nutritional value and therefore to increase competitiveness of the US grape growers and wine makers at the world markets. o Improved soil, water, and crop management practices and strategies that protect Oregon resources o Management of public and private rangelands will sustain and improve ecological values as desired by the public and the rural communities that depend on the natural resources. o Strategies for avoiding invasive pests will be in place o Plant disease resistance will lower the amount of pesticide use, resulting in a more healthful environment and reduced exposure of humans to hazardous chemicals.</p>
13	<p>Change Indicator 2 - Societal o Social change will occur through new perceptions of green technologies and social value or capital of horticultural landscapes to enhance human health, therapy, wellness, and social networks. o Social impacts include consumer awareness and appreciation of the abundance of locally grown ornamental plant materials and native species for use in landscapes will increase; also awareness of invasive species. o Social change will enhance quality of life in rural areas by improving economic stability of family farms, wineries, wine tasting, and tourism with new practices and cropping systems and/or livestock management practices/systems. o Social change will improve economic stability of families and quality of life with improved cropping systems. o Worker safety with bio-based pest control and dwarf rootstocks (short ladders) will be improved; farm workers will find other employment with increased mechanization. Local and community markets increase social networking in rural communities. o Increased opportunities for rural community marketers and processors will be developed; o Public health will be improved through the use of crops with improved nutritional value o Sustainable and economically viable wheat and dryland cropping industry for vibrant rural economy in eastern Oregon o The public has access to an ongoing research data base that allows for natural resource/land management decisions to have a fundamental basis in science.</p>

14	<p>Change Indicator 3 - Economic</p> <ul style="list-style-type: none"> <li>o The economic value of landscapes will increase. Cost and benefit analyses of plants usage to modify environments with green technologies will reveal positive economic impacts and improved health and wellness from horticultural therapy.</li> <li>o Economic impacts include reduced costs, increased benefits, and production efficiencies from use of water and nutrient budgets in recycled water systems, improved pest management, and diagnosis of plant problems to increase sales of quality products. Costs of regulatory procedures will be reduced with water and nutrient budgets and management systems.</li> <li>o Profitability of berry crops in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. Machine harvest technologies will be adapted or developed for Oregon to reduce production costs and improve competitiveness in global markets.</li> <li>o Profitability of vegetable and specialized seed crops is expected to improve as new cropping systems, cover crops, nitrogen management, reduced tillage, and cultivars are adopted by growers. Communication networks will enable timely communication and utilization of technologies to alert growers of weather related pest incidence, educational events, and practices.</li> <li>o Profitability of viticulture in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. Niche markets, wine tasting, and tourism are primary outlets for Oregon wines.</li> <li>o Profitability of tree fruits and nut crops in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. High density orchards are expected to improve production efficiencies and increase markets.</li> <li>o Agricultural producers will realize greater economic return in their cropping enterprises; Plant nutrient and other production input use will be optimized</li> <li>o Producers maximize the control of postharvest decay within the various production and marketing objectives of producers.</li> <li>o Biocontrols will reduce environmental damage and costs of grape growing and facilitate the development of the table and wine grapes with improved quality and nutritional value and therefore to increase competitiveness of the US grape growers and wine makers at the world markets.</li> <li>o Higher-value niche markets will be established</li> <li>o Beef producers in the Intermountain and Great Basin areas remain competitive on a regional, national, and global basis.</li> <li>o Producers greatly improve their reproductive efficiency by removing bad genes thus increasing productivity and economics of the industry. Industry thus has improved resource and economic sustainability through reduced costs and/or increased productivity.</li> <li>o Better understanding of the costs, benefits, and potential impact of legislation on the dairy industry, and thus more economically and environmentally sustainable systems for dairy and beef production.</li> <li>o Intense selection reduces needs for assistance in pasture lambing conditions.</li> <li>o Economic viability of farmers markets will be enhanced</li> <li>o Agricultural producers will realize greater economic return in their enterprises;</li> <li>o Increased potato yield will increase potato farmers' income as well as the stability of potato production of the world. The potential increase from 29,000 acres to as much as 100,000 acres will increase Oregon's market share and economic benefits.</li> </ul>
15	1b - sustainable gardening practices (eg. fertilizers, water, and pest management including organic), horticulture and aboriculture principles and practicea
16	1c - dryland production management systems use agronomic practices for commercially promising alternative crops under reduced tillage. * Producers, NRCS, conservation districts and environmental agencies learn about whole farm nutrient management. * Basic agronomic practices for commercially promising alternative crops under reduced tillage systems.
17	1d - irrigated production management systems use drip and micro sprinkler irrigation systems to produce increased crop yield and crop quality with less water and nitrogen than with furrow and regular sprinkler irrigation
18	6b - improved knowledge of consumer and market conditions and factors that affect business survival and competitiveness - Improved understanding of market conditions and knowledge to determine business choices. - Development of a process map for food business

	development and planning. - Training of nascent and existing food entrepreneurs in food business management. - Expanded knowledge base of factors important to distinguish different types of consumers and their food choices - Develop an understanding of motivations for food choice and strategies to impact them - Improved marketing approaches for local markets and community food systems
19	4c - identify genes involved in critical plant processes to improve plant qualities
20	5b - Improved information about biology, control and resistance of viral, bacterial, fungal diseases, especially disease reproduction, transport and spread; postharvest decay; models to predict risk; and relationships between disease susceptibility and disease resistance
21	5c - Elucidation of the underlying molecular mechanisms of pathogenicity (virulence), disease susceptibility (compatibility) and disease development, gene evolution, and engineered gene expression vectors
22	7 - integrate agricultural education into high school curriculums and community education
23	A2 - Plant management tools are used by private and public sector, for example: * Farmers will more strategically plan for crop production * Crop rotation sequences and green manure crops in combination with reduced or no nematicide use, particularly for short season potato crops to suppress nematode populations.
24	A5 - pest and pathogen management tools are used by growers, for example: * End users adopt new pesticide and pest management systems and strategies for working with invasive pests * District-specific control programs will reduce usage of fungicides with low efficacy and emphasize integrated control practices. * Growers, packers and extension faculty incorporate practices to lower decay risk, including reduced fungicide usage, and identify high risk fruit lots and to market these before decay has time to develop in storage. * Interaction of program components and the overall efficacy of various combinations of orchard, postharvest, and storage factors will be the guides to the description of programs for implementation in the pear industry. * Determine packinghouse water system contamination by fungal pathogens. Commercial service lab can apply PCR technology to maintain sanitation determine most effective fungicides for each species. * Customized decay control program for each unique pathogen complex.
25	A7 - Agricultural education produces the next generation of growers and educators
26	A6b - Consumer business knowledge leads to improved opportunities, survival, and profitability in food enterprises, as well as new and improved value-added products - New and existing businesses expand markets based on new understanding about market factors - Increased business activity and success in the Northwest food industries. - More successful starts by food businesses
27	1e - protection of natural environment from agricultural chemicals, for example: - Reduce the fate of agricultural chemicals in remote aquatic ecosystems - Improve policies or regulation of pesticides
28	4b - create new plant varieties for improved attributes

## **Outcome #1**

### **1. Outcome Measures**

1a. improved plant production management systems, including precision systems, cultural practices, conservation strategies, innovations, pest control, and organic systems

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

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

#### **Issue (Who cares and Why)**

On a small scale, drones are already in Oregon airspace. Researchers are using drones to study potatoes in Eastern Oregon. Don Horneck, an agronomist at the research station, reports that the Columbia Basin produces some of the highest yields of potatoes of anywhere in the world. Oregon farmers sold more than \$170 million worth of potatoes last year. But it's a plant that's both expensive to grow and susceptible to problems associated with insects or disease.

#### **What has been done**

Remotely-piloted vehicles (UAVs) leased from Boeing are used at the OSU Hermiston Agricultural Research and Extension Center. Horneck will deliberately stress potato plants by cutting back the amount of water and fertilizer they get in different sections of the field. Researchers fly the UAV over the crops and see whether the UAV digital camera can note insect or disease issues via different light wavelengths before workers can see it."

#### **Results**

Farmers already scout their fields with traditional airplanes, but because the UAVs are able to fly at lower altitudes than the farmer's planes these cameras should be able to capture images with much higher resolution. Also, many of the fields are massive, hundred-plus acres. But with more information, growers can be more efficient with inputs like water, fertilizer and pesticides. Use of the UAVs have the potential to revolutionize precision agriculture. In irrigated fields, operators can program each of the nozzles running along the sprinkler system. If the UAV can indicate insect infestation or lack of moisture, the operator can open or close a nozzle or add fertilizer or pesticide to certain parts of the field, not the entire field. The technology can be applied to other fields of research for things like water quality, forest management or invasive species.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

#### Outcome #2

##### 1. Outcome Measures

2a - improved animal reproductive biology and management for better fertility and reduced uterine infections in dairy and beef cattle and sheep; as well as better understanding of reproductive genetics and developmental biology

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	2

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

###### **Issue (Who cares and Why)**

For the past seven years, summer upwelling has brought acidified water onshore, creating ocean acidification (OA) conditions that adversely affect the growth and survival of oyster larvae at commercial hatcheries. As a result, a "seed crisis" has afflicted the West Coast oyster growers, limiting availability of oyster seed for outplanting. The industry produces over six million pounds of oyster meat each year which sells for almost \$5 million. In 2010, the oyster industry's production was found to have affected 91% of the economic sectors in Oregon.

###### **What has been done**

The Molluscan Broodstock Program (MBP) of the Coastal Oregon Marine Experiment Station has been working to develop oysters with enhanced traits through traditional oyster breeding. MBP was collaboratively funded over a number of years by USDA Special Grants, OSU formula grants, and industry and foundation funding, along with assistance from USDA-ARS personnel. ARS has contributed through genetic evaluation of oyster families to provide information for improved survivability, reproduction, and growth.

###### **Results**

Hatchery operators reported that larvae derived from selected MBP broodstock from the performed better than larvae from wild oysters or non-MBP stock in OA conditions. As a result, the industry has been able to outplant larvae in the face of adverse conditions. Growers has said that without the program, the industry would have faced major economic hardships, including failures of some oyster farms. Information gained through the MBP research has been shared at annual meetings of the oyster growers and researchers. Future studies will focus on experiments to provide a better understanding of OA on larval physiology and provide genetic tools that can be used to evaluate the degree of stress in larvae exposed to OA conditions.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems

#### Outcome #3

##### 1. Outcome Measures

2b - expanded forage and nutrient management knowledge to understand how management practices can synchronize the relationship between forage nutrient supply and cow nutrient requirements, and how feedstuffs can influence the health and physiological stress of the calf.

##### 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)**

Selenium is found in heavy concentrations in some parts of the country, and at low ones in others, like Oregon. Ranchers often provide selenium to livestock as a supplement, but applications must be monitored carefully because too much of the mineral be harmful to animals. Selenium delivered through plants in an organic form is safer than directly feeding to calves in an inorganic form, such as salt, says Jean Hall, a researcher with the OSU College of Veterinary Medicine. Application in this way may also be cost-effective for ranchers.

###### **What has been done**

During field trials, selenium was added at varying levels to alfalfa fields after the first of three scheduled cuttings. Regardless of the application level, over 80% was taken up by the time of the second cutting. The remaining selenium by taken up by the last cutting. Regardless of the amount of selenium applied, the take up percentage remained the same. So double the application level, twice as much selenium was taken up. Researchers fed the fortified hay to weaned beef calves. Several weeks later, these calves had higher selenium blood levels than control calves, and weighed 10% more. It also appeared that selenium boosted efficacy of vaccinations, helping to boost anti-body production.

### Results

The study shows that selenium boosts growth and vaccination response of weaned beef calves, which results in decreased mortality and improved slaughter weights. While Oregon is the only state that permits fields to be artificially fertilized with selenium, the results may be a strategy for ranchers in other areas where selenium is very low. Results of the study have been published in PLOS ONE.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems

### Outcome #4

#### 1. Outcome Measures

4a - plant breeding for improved or novel plant attributes and for human health benefits, e.g., antioxidants

#### 2. Associated Institution Types

- 1862 Research

#### 3a. Outcome Type:

Change in Knowledge Outcome Measure

#### 3b. Quantitative Outcome

Year	Actual
2013	3

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

##### Issue (Who cares and Why)

Barley is one of the oldest cultivated grain. However, while it is the fourth largest grown grain crop, it is grown primarily for animal feed. Yet, it has many attributes that could enhance human health and food security. The crop has also an important asset in the growing microbrewery industry, both in the Pacific Northwest, as well as elsewhere in the world.

### **What has been done**

: Pat Hayes, barley breeding lead at OSU, evaluates how well the grain performs in the kitchen and brewery. The research team looks at genes that deal with cold tolerance, disease resistance, and lower water and fertilizer requirements; they also seek genes responsible for malting quality, nutritional properties and flowering time. The team uses a double haploid production technique, which regenerates plants from pollen and creates genetically pure lines in one generation, as opposed to six to eight years in traditional breeding. Hayes is also making crosses with multicolored barley from Mongolia, hoping to develop varieties with different flavors and aromas to attract consumers.

### **Results**

Craft brewers want to create unique flavors, and have turned to Hayes for varieties that reflect the terroir—the soil and climate—of Oregon, much like the approach in wine grapes. Additionally, the team are breeding barleys that have desirable malting qualities; this work has caught the attention of California's Sierra Nevada Brewing Co. and Wisconsin's New Glarus Brewing Co. The brewers plan to make beer from 50 to 100 exotic varieties of barley from the world grown in 2012 by OSU. Then they'll analyze how the beer tastes. Hayes also wants to see barley grow in the percentage of people's diets. Barley contains beta-glucan, which has been shown to reduce cholesterol. Low glycemic index and high fiber content makes barley a good food choice for those with diabetes or for people seeking to lose weight. In conjunction, Andrew Ross, OSU food scientist, has developed consumer recipes for bread and related food stuff from barley, which requires more liquid and produces a denser product due to the high fiber. His pretzels have been served in the OSU's president's box at football games.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

## **Outcome #5**

### **1. Outcome Measures**

5a - develop optimum pest management by identifying factors affecting herbicide activity, registering herbicides, controlling weeds in organic and no-till production; learning basic pest biology, registering new pesticides, finding application rates, and identifying risks associated with a pest as it becomes established

### **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)

Growers are concerned about the arrival of the brown marmorated stink bug, a voracious, nonpicky eater of apples, berries, vegetables, grain and even ornamental trees. Sheltering in homes over winter allows this particular pest to continue to grow, and they quickly multiply. They cause the flavor of berries to resemble the stink of the bugs, their bite causes blemishes in vegetables, and attacks cause fruit and nuts to shrivel.

#### What has been done

OSU, part of a consortium of partners funded by USDA, continues to seek control measures and management solutions for growers. They work on how to identify BMSB and their favorite plants, document damage, extract and identify the proteins in saliva from stink bugs to pave the way for new pest control methods. OSU researchers are testing specific insecticide controls for the brown marmorated stink bug, as none are registered for the insect. Herbicides and fungicides are not known to be effective.

#### Results

OSU researchers issued a warning in late summer 2013 of an increased risk of damage to late-ripening crops after discovering record levels of the brown marmorated stink bug, a newly established invasive pest in Oregon. OSU's statewide survey for the bug is ongoing and early returns this year show higher population densities in nearly every area of Oregon. While the stink bug been established in urban counties near Portland and the Willamette Valley for years ? and in Hood River and Wasco County since 2012 ? the survey found the range of the bugs has recently expanded to more rural environments, including farms of all sizes. Growers also now have access to a number of print and online resources.

The alert comes at a critical time with harvest looming for many crops

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
216	Integrated Pest Management Systems

## **Outcome #6**

### **1. Outcome Measures**

6a - economic studies help Producer groups learn about factors shaping global markets and productivity-convergence effects on US agricultural and processed food production and trade

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

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

#### **Issue (Who cares and Why)**

Specialty crops, such as fruits, nuts and vegetables, are some of the highest value agricultural products and account for about one-third of cash receipts from all crops in the United States. These crops have important export, as well as domestic, economic import. Many specialty crops thrive in the West under irrigation, but are vulnerable to extreme climate events, including frosts, heat waves, drought, and excess moisture. Such events can ruin crops and hurt a farmer financially. Specialty crops' sensitivity to irrigation and climate extremes suggests that it is prudent to better understand how extreme climate events affect irrigation management for them.

#### **What has been done**

OreCal is a policy research collaboration between the Center for Agricultural & Environmental Policy at Oregon State University and the University of California Agricultural Issues. Center at UC Davis. OreCal recently announced the release of a new issues brief from research over the past couple of years that analyzes the vulnerability of specialty crops to extreme climate events and adaptive irrigation management (OreCal Issues Brief 012, <http://orecal.org>).

#### **Results**

The research provides a number of useful economic and precision agriculture information. Using irrigation to mitigate frost damage to crops increases the likelihood to adopt sprinklers by 18% for vegetables and 9% for orchard/vineyard. It decreases the likelihood to adopt gravity technologies by 13% for vegetables and 4% for orchard/vineyard. Using irrigation to reduce heat stress in orchards and vineyards increases the likelihood to adopt sprinklers by 15% and decreases the likelihood to adopt drip by 18%. Several irrigation management decisions have a climate threshold. How farmers respond to climate change depends on whether they are located below the threshold (cooler and wetter locations) or above it (warmer and dryer locations).

### **4. Associated Knowledge Areas**

**KA Code**    **Knowledge Area**  
502            New and Improved Food Products

**Outcome #7**

**1. Outcome Measures**

A4 - Adoption of new varieties will reduce yield losses and expenses, rejuvenate orchards, achieve better productivity and efficiency, provide environmental benefits (less fungicide applications, etc.), allow effective competitiveness on the world market of Commercial processors and fresh market growers, as well as home gardeners, achieve greater production efficiency, more stable productivity, and reduced costs from the use of improved varieties.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	3

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

**Issue (Who cares and Why)**

Farmers often make their variety selection based on disease resistance and can neglect other factors. This is especially critical in water limited eastern Oregon.

**What has been done**

OSU researchers help wheat farmers make better choices by offering pros and cons of various options. For example, Mike Flowers, extension cereals specialist, and Bob Zemetra, OSU wheat breeder, advised growers to plant a mix of wheat varieties for different attributes, including maturity. In wet, cool years, late-maturing varieties tend to perform better. In dry years, early-maturing varieties tend to be better. Breeders work to find varieties that higher yielding, disease resistant and meets a local market to reduce the need to store seeds or reduces growers' shipping costs.

**Results**

Planting a mix of varieties help farmers spread their risk across a greater reach and not just counting on one thing to carry them through. Getting farmers to walk their fields, beginning in the spring. In dry spells, certain strip rust and crown rot will emerge, which growers tend to forget about because they weren't seen for several years.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

## **Outcome #8**

### **1. Outcome Measures**

2c - improved animal fertility and genetic stock, for example: o Producers and animal health professionals improve fertility and prevent uterine infections in dairy cattle from implementing every-day on-farm practices. o Industry stores sperm cells with minimal loss of function for use as a commodity and for long-term maintenance of genetic stock

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	2

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

#### **Issue (Who cares and Why)**

Producer experience indicates that high strung, poorly tempered stock often do not perform as well as herd mates with a more moderate disposition. Feedlot studies show steers with calmer dispositions out gaining steers with the most excitable temperaments. Links are also being made by research between disposition and health, including response to vaccination. Determining if a link exists between reproductive performance and disposition has been difficult to prove. Anecdotally, producers and A.I. technicians have noted that cows with bad temperaments are less likely to conceive to A.I.

#### **What has been done**

Reinaldo Cooke, OSU Eastern Oregon Agricultural Research Center researcher, compared weaned crossbred heifers that were not handled with those acclimated to people and going through a working chute. Both groups were tested for levels of Cortisol, a hormone associated with stress. At the end of the experiment Cortisol levels for the trained group were lower than those of the control group.

#### **Results**

: The trained group reached puberty at a faster rate than the controls, with nearly a 20% difference. Having heifers start cycling sooner can greatly improve reproduction by allowing heifers to be bred sooner and calve early in the calving season, also allowing the heifers to have a longer recovery period before breeding again. Furthermore, previous work by Cooke with mature cows showed that their disposition (agitation and aggression scores) was improved with acclimation to humans and higher aggression scores resulted in lower pregnancy rates in the breeding season. Results provide additional basis to existing reasons for culling cattle with bad temperaments. Including disposition as part of the breeding criteria may yield both improved reproductive health, breeding rates and handling ease.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems

#### Outcome #9

##### 1. Outcome Measures

A3 - Animal producers improve their economic competitive advantage and improve the ecological sustainability of production system

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

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

###### **Issue (Who cares and Why)**

There is an ongoing debate over whether grazing on western public lands worsens ecological alterations caused by climate change.

###### **What has been done**

Researchers, who work for nine universities and the U.S. Department of Agriculture, responded to the debate in a peer-reviewed journal article published by the journal Environmental Management.

**Results**

Based on the summary of scientific studies, the 27 authors dispute the notion that eliminating grazing will provide a solution to problems created by climate change. To cope with a changing climate, the authors say land managers will need access to all available vegetation management tools, including grazing.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
302	Nutrient Utilization in Animals
307	Animal Management Systems

**Outcome #10**

**1. Outcome Measures**

A1 - Conservation strategies adopted o Conservation bio-control strategies are implemented differently and active restoration strategies occur. Land owners and managers assess ecosystem services provided by their riparian restorations via a user-friendly web tool. o Growers adopt improved, scale-dependent practices selected for various market niches with emphasis on reducing environmental degradation and impact. Commercial small farms will have more diverse and economically viable technologies and production techniques or systems available for their use o Growers implement drip irrigation and produce more marketable yields of onions, potatoes, and poplar trees than with furrow or sprinkler irrigation.and achieve efficient use of soil nitrate and the other available N sources under drip irrigation. o Generation of the viral vectors for grapevine disease control and functional genomics vectors have a potential for replacing current strategies of using chemical fungicides and bactericides with viral biocontrol strategies.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	1

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

**Issue (Who cares and Why)**

Federal land-use agencies, such as the Bureau of Land Management, Forest Service, Natural Resources Conservation Service and highway districts, are in need of native plant seed to restore large areas of land following wildfires in the Pacific Northwest and Western states. Stand establishment and weed control are two of the toughest issues facing growers interested in

producing seed for this market.

**What has been done**

OSU researchers, especially those at the Malheur Experiment Station, have developed numerous tactics to produce needed native seed. This has allowed increasing numbers of farmers who are growing seed. The station is growing about 40 different native plant species. The researchers have been willing to take on a lot of new species that have never been grown in an agricultural situation before, thus, needing to develop all facets of information. Many of the plants have extremely small seed that has trouble growing through hardened soil that crusts over the winter and birds enjoy the small seedlings that emerge in spring.

**Results**

OSU researcher Erik Feibert found that using row covers in the fall and winter has been found to be the best way to help native plants and grasses establish a stand. These covers protect the seed from bird damage and help maintain a more uniform soil moisture level and temperature, which helps prevent soil crusting.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

**Outcome #11**

**1. Outcome Measures**

A6a - Improved agricultural economies  
 o The knowledge generated about productivity-convergence will be crucial in designing policies to improve the welfare of agricultural producers and food processors and the general public who will be affected by the evolution of these industries (e.g., food quality and safety, resource scarcity and pollution).  
 o Domestic policymaking and multilateral trade negotiations will mitigate effects of climate change in reduction of trade barriers and subsidies.  
 o Climate change will be related to changes in comparative advantage in international crop production, and in turn the pattern and volume of trade. This information will be important in the context of domestic policymaking and multilateral trade negotiations as it pertains to reduction of trade barriers and subsidies.

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
-------------	---------------

2013

0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

In years past, Harry & David (HD) would only have locally grown signature Royal Riviera brand Comice pears available from September through February. For decades that meant months passed before the Medford, Oregon, gourmet food and gift company could once again offer pears to its mail-order customers. HD needed to reduce the gap.

#### What has been done

Comice pears aren't suited for growth just anywhere, said David Sugar, OSU horticulture professor based at the Southern Oregon Research and Extension Center in Medford. He has worked with growers and food industry representatives in Chile and Argentina and keeps in contact with former students in both countries. His research has helped growers in Chile improve pear appearance, storage life and eating quality up to the standards of HD. With Comice, in particular, five months is about as long as you can hold them in storage, Sugar said. "To provide a steady supply, the six-month stagger between southern and northern hemispheres is very useful."

#### Results

HD turned to growers in Chile and New Zealand in the early 1990s, seeking to capitalize on the popularity of its high-end fruit offerings. Without the Southern Hemisphere countries, HD would have limited offerings at certain times of the year, as well as fewer opportunities. In 2013 HD expected to import 2.5 million pounds of fruit from Chile, with pears accounting for just over half of the total. This is only a fraction of the some 2.6 million tons of fresh fruit, worth \$3.6 billion, exported to the U.S., led by grapes, apples and blueberries, according to the Fruit Growers Federation of Chile. The first Chilean pears arrive two to three weeks ahead of those from New Zealand. Economic conditions, both in Chile and the United States, have resulted in consolidations and changing ownerships, according to HD. One Chilean grower said that when the U.S. sneezes, Chile gets a cold. HD has set an 85 percent gift-grade standard for the Chilean growers. If the standard is exceeded once the fruit arrives in Medford, the growers collect on incentives. If it falls below, payments fall.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

### Outcome #12

#### 1. Outcome Measures

Change Indicator 1 - Ecological / Environmental o Landscapes will impact the way Oregonians use and manage plants to create beauty, modify environment, and improve health and well-being of individuals and communities. This program will change the way people use plants to modify their environment such as moderating temperature on buildings, improving water infiltration on surfaces, contributing to ecosystem services at landscape or watershed scales, etc. o Food/farm systems reduce surface and/or groundwater or other pollution in the environment, while improving nutrient and water budgets, and organic production systems. o New reduced risk, environmentally safer

pest control tools will be available that are target pest specific will facilitate the implementation of IPM programs. o Environmental change will occur from temperature modifications; enhanced water conservation and wildlife; reduced runoff, fire incidence and pests; improved nutrient use and recycling; and other ecosystem services. o Better ecological methodologies will lead to more social, economic, and environmental benefits and cost effective and sustainable restoration. Improved valuation of ecological services associated with restorations will greatly facilitate market-based conservation practices such as mitigation banking and effluent trading. Better conservation bio-control strategies will decrease the costs associated with insect losses and the use of insecticides. o enhance the nation's natural resource base and environment by revealing cost-effective means to control plant diseases and reduce the need for pesticides. o Biocontrols will reduce environmental damage and costs of grape growing and facilitate the development of the table and wine grapes with improved quality and nutritional value and therefore to increase competitiveness of the US grape growers and wine makers at the world markets. o Improved soil, water, and crop management practices and strategies that protect Oregon resources o Management of public and private rangelands will sustain and improve ecological values as desired by the public and the rural communities that depend on the natural resources. o Strategies for avoiding invasive pests will be in place o Plant disease resistance will lower the amount of pesticide use, resulting in a more healthful environment and reduced exposure of humans to hazardous chemicals.

## 2. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2013	4

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

: Irrigation from the Owyhee Project and research from the Malheur Experiment Station have helped make the Western Treasure Valley a major producer of sugar beets, potatoes and some of the best onions in the nation. But with little rainfall each year and precious few sources of water, farming successfully in the high desert is a unique challenge. This region receives only 9 inches of rain a year.

#### What has been done

Using the latest in crop technology and working hand-in-hand with local farmers, OSU researchers at the Malheur station are working toward producing crops in the high desert through precision irrigation. Wires crawl through fields like tentacles. The wires measure soil-water tension, the natural force needed for plants to pull water from the soil. When the sensors detect high soil-water tension, it means that the soil is thirsty and the system prompts the release of just the right amount of irrigation dripped onto the plant roots to quench the thirst.

### Results

No local farmers used drip irrigation when OSU began researching precision irrigation systems in the early 1990s. Since then, more than half of Malheur County growers have installed drip in their fields. Additionally, after more than 30 years of research, Shock continues to push the boundaries of research, to grow bigger onions at lower cost using fewer inputs and less water while helping farmers make more money. Thanks to OSU research, onions have swelled so large that some have earned the category of super colossal. Sales have also swelled, helping Oregon onion harvest rack up \$115.8 million in farm gate sales in 2012. Since Shock started his research, local farmers have more than tripled onion plantings. And groundwater quality has also improved, as Malheur research has offered ways to reduce fertilizer, pesticide, and water use while producing outstanding onions. Finally, OSU researchers, led by Malheur superintendent Clint Shock, have also developed specific equations for calibrating the sensors, work that has enabled manufacturers to successfully market precision irrigation instruments worldwide.

### 4. Associated Knowledge Areas

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

### Outcome #13

#### 1. Outcome Measures

Change Indicator 2 - Societal o Social change will occur through new perceptions of green technologies and social value or capital of horticultural landscapes to enhance human health, therapy, wellness, and social networks. o Social impacts include consumer awareness and appreciation of the abundance of locally grown ornamental plant materials and native species for use in landscapes will increase; also awareness of invasive species. o Social change will enhance quality of life in rural areas by improving economic stability of family farms, wineries, wine tasting, and tourism with new practices and cropping systems and/or livestock management practices/systems. o Social change will improve economic stability of families and quality of life with improved cropping systems. o Worker safety with bio-based pest control and dwarf rootstocks (short ladders) will be improved; farm workers will find other employment with increased mechanization. Local and community markets increase social networking in rural communities. o Increased opportunities for rural community marketers and processors will be developed; o Public health will be improved through the use of crops with improved nutritional value o Sustainable and economically viable wheat and dryland cropping industry for vibrant rural economy in eastern Oregon o The public has access to an ongoing research data base that allows for natural resource/land management decisions to have a fundamental basis in science.

Not Reporting on this Outcome Measure

## **Outcome #14**

### **1. Outcome Measures**

Change Indicator 3 - Economic

- o The economic value of landscapes will increase. Cost and benefit analyses of plants usage to modify environments with green technologies will reveal positive economic impacts and improved health and wellness from horticultural therapy.
- o Economic impacts include reduced costs, increased benefits, and production efficiencies from use of water and nutrient budgets in recycled water systems, improved pest management, and diagnosis of plant problems to increase sales of quality products. Costs of regulatory procedures will be reduced with water and nutrient budgets and management systems.
- o Profitability of berry crops in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. Machine harvest technologies will be adapted or developed for Oregon to reduce production costs and improve competitiveness in global markets.
- o Profitability of vegetable and specialized seed crops is expected to improve as new cropping systems, cover crops, nitrogen management, reduced tillage, and cultivars are adopted by growers. Communication networks will enable timely communication and utilization of technologies to alert growers of weather related pest incidence, educational events, and practices.
- o Profitability of viticulture in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. Niche markets, wine tasting, and tourism are primary outlets for Oregon wines.
- o Profitability of tree fruits and nut crops in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. High density orchards are expected to improve production efficiencies and increase markets.
- o Agricultural producers will realize greater economic return in their cropping enterprises; Plant nutrient and other production input use will be optimized
- o Producers maximize the control of postharvest decay within the various production and marketing objectives of producers.
- o Biocontrols will reduce environmental damage and costs of grape growing and facilitate the development of the table and wine grapes with improved quality and nutritional value and therefore to increase competitiveness of the US grape growers and wine makers at the world markets.
- o Higher-value niche markets will be established
- o Beef producers in the Intermountain and Great Basin areas remain competitive on a regional, national, and global basis.
- o Producers greatly improve their reproductive efficiency by removing bad genes thus increasing productivity and economics of the industry. Industry thus has improved resource and economic sustainability through reduced costs and/or increased productivity.
- o Better understanding of the costs, benefits, and potential impact of legislation on the dairy industry, and thus more economically and environmentally sustainable systems for dairy and beef production.
- o Intense selection reduces needs for assistance in pasture lambing conditions.
- o Economic viability of farmers markets will be enhanced
- o Agricultural producers will realize greater economic return in their enterprises;
- o Increased potato yield will increase potato farmers' income as well as the stability of potato production of the world. The potential increase from 29,000 acres to as much as 100,000 acres will increase Oregon's market share and economic benefits.

Not Reporting on this Outcome Measure

## **Outcome #15**

### **1. Outcome Measures**

1b - sustainable gardening practices (eg. fertilizers, water, and pest management including organic), horticulture and aboriculture principles and practicea

Not Reporting on this Outcome Measure

## **Outcome #16**

### **1. Outcome Measures**

1c - dryland production management systems use agronomic practices for commercially promising alternative crops under reduced tillage. \* Producers, NRCS, conservation districts and environmental agencies learn about whole farm nutrient management. \* Basic agronomic practices for commercially promising alternative crops under reduced tillage systems.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	1

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

#### **Issue (Who cares and Why)**

New alternative crops can improve agricultural production and provide diversity to growers? portfolios in the dryland wheat growing areas of eastern Oregon and Washington. However, research is needed to find herbicides that can manage weeds without damaging the crop, and timing harvest to gather seeds that mature at different times in the same plant. The whole package for growers is needed for new crops.

#### **What has been done**

Stephen Machado recently began test plots on the Columbia Basin Agricultural Research Center acreage of quinoa as a potential dryland crop for the area. Quinoa, typically produced in the Andes Mountains of South America, is highly nutritious.

#### **Results**

Quinoa may provide a new alternative to growing traditional dryland wheat. A surge in global demand is driving the price as high as \$3,200 per ton, according to reports. This is about 10 times the current value of wheat.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

#### Outcome #17

##### 1. Outcome Measures

1d - irrigated production management systems use drip and micro sprinkler irrigation systems to produce increased crop yield and crop quality with less water and nitrogen than with furrow and regular sprinkler irrigation

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	2

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

###### **Issue (Who cares and Why)**

: Irrigation from the Owyhee Project and research from the Malheur Experiment Station have helped make the Western Treasure Valley a major producer of sugar beets, potatoes and some of the best onions in the nation. But with little rainfall each year and precious few sources of water, farming successfully in the high desert is a unique challenge. This region receives only 9 inches of rain a year.

###### **What has been done**

Using the latest in crop technology and working hand-in-hand with local farmers, OSU researchers at the Malheur station are working toward producing crops in the high desert through precision irrigation. Wires crawl through fields like tentacles. The wires measure soil-water tension, the natural force needed for plants to pull water from the soil. When the sensors detect high soil-water tension, it means that the soil is thirsty and the system prompts the release of just the right amount of irrigation dripped onto the plant roots to quench the thirst.

###### **Results**

OSU researchers, led by Malheur superintendent Clint Shock, have also developed specific equations for calibrating the sensors, work that has enabled manufacturers to successfully market precision irrigation instruments worldwide.

#### 4. Associated Knowledge Areas

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

#### Outcome #18

##### 1. Outcome Measures

6b - improved knowledge of consumer and market conditions and factors that affect business survival and competitiveness - Improved understanding of market conditions and knowledge to determine business choices. - Development of a process map for food business development and planning. - Training of nascent and existing food entrepreneurs in food business management. - Expanded knowledge base of factors important to distinguish different types of consumers and their food choices - Develop an understanding of motivations for food choice and strategies to impact them - Improved marketing approaches for local markets and community food systems

##### 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)

In the food business, competition is fierce and the cost of marketing is high. These days, price and taste are not the only factors influencing grocery shoppers' decisions to buy. Some also want to know how and where a product was produced or caught. Enter the "eco-label" that certifies dolphin-safe tuna, organic pasta, and fair-trade coffee. Researchers at the Food Innovation Center, the first urban agricultural experiment station in the United States, are studying how this kind of packaging can affect shoppers' behavior, choices, and thinking.

###### What has been done

According to Cathy Durham, a marketing economist at the center, eco-labels can connect with consumers' attitudes about the environment, health, and social justice. Durham is also studying

the feasibility of an artisan cheese industry in Oregon, how local foods are defined and marketed, and the differences in consumer attitudes toward wine bottles topped with corks or screw caps. Consumer research by the center can reduce risk and help pave the way for success in the market.

**Results**

In one study, shoppers showed a preference for apples packaged with eco-labels over those produced and labeled in a conventional way?at an appropriate price point; in other words, eco-labels can positively influence consumer decisions if the price is right.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
502	New and Improved Food Products
903	Communication, Education, and Information Delivery

**Outcome #19**

**1. Outcome Measures**

4c - identify genes involved in critical plant processes to improve plant qualities

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	1

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

**Issue (Who cares and Why)**

Developing new varieties often takes years.

**What has been done**

By combining traditional plant breeding with ever-faster genetic sequencing tools, researchers are making fruits and vegetables more flavorful, colorful, shapely and nutritious. In the last 10 years or so they have been able to approach their work in completely new ways in part because genetic sequencing technology is becoming so fast and cheap. "There's been a radical change in the tools we use," says Jim Myers of Oregon State University, who has been a plant breeder for more than 20 years and recently created an eggplant-purple tomato. What is most exciting to Myers, and what he never thought he would be doing, is going in and looking at candidate genes

for traits. As the price of sequencing continues to drop, it will become more and more routine to do sequences for every individual population of plants of interest.

### Results

In particular, these tools are helping breeders pivot their attention toward qualities of food that are important to consumers, instead of fixating solely on the needs of growers. Aided by genomics and related molecular tests, breeders have managed to create a cornucopia of new foods that are already available at some grocery stores and farmer's markets, including cantaloupe that's firm and ripe in the winter, snack-size bell peppers, broccoli that brims with even more nutrients than usual, onions that do not offend the eye and tomatoes that do not disappoint the tongue.

## 4. Associated Knowledge Areas

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

### Outcome #20

#### 1. Outcome Measures

5b - Improved information about biology, control and resistance of viral, bacterial, fungal diseases, especially disease reproduction, transport and spread; postharvest decay; models to predict risk; and relationships between disease susceptibility and disease resistance

#### 2. Associated Institution Types

- 1862 Research

#### 3a. Outcome Type:

Change in Knowledge Outcome Measure

#### 3b. Quantitative Outcome

Year	Actual
2013	3

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

##### Issue (Who cares and Why)

Zebra chip has been a significant pest for Southwestern U.S. potato growers since it was discovered in Texas in 2000. It was not considered a significant problem in the Pacific Northwest until 2011, although the insect that vectors zebra chip, the potato psyllid, has been in evidence since the late 1990's. The disease caused significant crop loss in isolated fields in 2011 and led to a temporary ban on fresh potato shipments from the Northwest overseas in 2012.

##### What has been done

OSU researchers have conducted research for the past three years and have presented their findings to growers at Experiment Center field days, at grower workshops and farm fairs.

**Results**

Sylvia Rondon, OSU Extension entomologist based at the Hermiston Agricultural Research and Extension Center, found that the pathogen that causes zebra chip appears to survive better in mild temperatures, as the pathogen is heat sensitive, shutting down in temperatures above 90 degrees Fahrenheit. Monitoring the edges of fields may be sufficient in cases where insect pressure is low, research showing that there was no significant difference between monitoring psyllid populations in the middle of fields and the edges. However, researchers also found that the psyllid can survive the Pacific Northwest's winters on a weed plentiful in the Columbia Basin and Idaho, the bittersweet nightshade, thus, enabling overwintering of the pathogen and creating a reservoir of disease. Thus, monitoring, although time consuming work, is an important management tool.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

**Outcome #21**

**1. Outcome Measures**

5c - Elucidation of the underlying molecular mechanisms of pathogenicity (virulence), disease susceptibility (compatibility) and disease development, gene evolution, and engineered gene expression vectors

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

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

**Issue (Who cares and Why)**

Highly contagious fire blight (*Erwinia amylovora*) disease affects pear and apple orchards throughout the western United States. In the state of Oregon, nearly 250,000 acres can be negatively impacted by this pathogen, which causes affected plant tissue to appear blackened or scorched by fire. Up to now methods for fire blight detection have been lacking due to time

needed for results and expense of testing.

#### **What has been done**

Ken Johnson in the OSU Department of Botany and Plant Pathology has worked on early detection of the pathogen. Johnson says that molecular technology is hard to put in the hands of just anyone. To this end, he developed a new tool called loop-mediated isothermal amplification or LAMP. This technique utilizes design primers to detect and amplify sequences of DNA unique to fire blight. A LAMP reaction can be done with a 12-volt power supply under field conditions. Thus, LAMP has the potential to implement early detection of fire blight at a local level (on-farm) instead of in a laboratory.

#### **Results**

Logistically there are some drawbacks to the technology: performing the assay requires personnel with excellent laboratory skills and a thorough understanding of the risk of molecular contamination, the rapid development of populations of fire blight when temperature conditions were favorable, and the requirements for routine sampling of flowers, overnight shipping and quick dissemination of LAMP results. However, the team evaluated the ability of this assay to detect blight in washes of pear and apple flowers where it grows prior to infection. Results thus far have been promising. More promising are expected technological advances that offer the potential for point-of-care (i.e., on-site) detection by non-professionals, such as the recent adaptation of LAMP to lateral flow devices. With further development of pathogen detection technologies for use on-site, this early warning protocol will become a key component of fire blight prediction systems.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

#### **Outcome #22**

##### **1. Outcome Measures**

7 - integrate agricultural education into high school curriculums and community education

##### **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)

Currently, a shortage of scientists for agricultural positions exists throughout the country. Efforts are needed to revitalize an interest in agriculture as a career path and ensure that secondary school students have the requisite competencies to succeed in college and careers.

#### What has been done

OSU Agricultural Education Program director Greg Thompson participates on a USDA multistate project with a focus on a framework for secondary schools agriscience education programs that emphasizes the STEM content in agriculture. The desired end result of this research project will be an abundant supply of well-educated workers in careers that require agricultural scientific knowledge.

#### Results

The project was just approved by NIFA in May, 2013, so efforts are focused primarily on addressing Objectives 1 and 2 of the project during FY2014. These are to: 1) Identify practices, cross-cutting concepts, and disciplinary core ideas to be included in a secondary school agriscience program; and 2) Identify teaching methods, resources (facilities, equipment, materials, etc), and techniques currently utilized by exemplary teachers. The group also proposed coordinating activities with the American Association for Agricultural Education's Special Interest Group (SIG) on Academic Integration.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

### Outcome #23

#### 1. Outcome Measures

A2 - Plant management tools are used by private and public sector, for example: \* Farmers will more strategically plan for crop production \* Crop rotation sequences and green manure crops in combination with reduced or no nematicide use, particularly for short season potato crops to suppress nematode populations.

#### 2. Associated Institution Types

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	4

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

**Issue (Who cares and Why)**

Nurseries are among many types of growers that face depredation of insect pests on their crops.

**What has been done**

The use of biocontrols, or predator bugs, has grown steadily since the mid-1990s. Evergreen Growers Supply, a distributor of beneficial insects, estimates their sales have increased about 20 percent a year over the past decade. Growers use the program to control aphids, whiteflies, fungus gnats, mites, thrips and other pests. Some crops are more conducive to beneficial insects and some pests are more easily controlled with beneficials than others.

**Results**

Ron Tuckett, a plant protection manager at Monrovia, said its nursery is saving between 30 and 70 percent in its mite control program since it started releasing thousands of beneficial bugs in its greenhouses. This has contributed to a major reduction in their chemical usage. But Tuckett said it is not all just about the costs as they see a big improvement in quality. The production crew at Woodburn Nursery and Azaleas, also noticed that plant quality had looked as good as it does after initiating biocontrols. The tough part in implementing a biocontrol program is believing that it actually works. OSU Extension entomologist Robin Rosetta said it is a long learning curve, but people can have success right away. Biocontrols is an area within pest management where the more knowledge you have, the more successful you can be. For example, Woodburn Nursery has found biocontrols work best in greenhouses. On outdoor nursery operations, winds tend to disperse the beneficial insects before they can do their work. The nursery also has found it crucial to release the good bugs before insect pest numbers build, that is, the nursery needs to be preventative.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
216	Integrated Pest Management Systems

## **Outcome #24**

### **1. Outcome Measures**

A5 - pest and pathogen management tools are used by growers, for example: \* End users adopt new pesticide and pest management systems and strategies for working with invasive pests \* District-specific control programs will reduce usage of fungicides with low efficacy and emphasize integrated control practices. \* Growers, packers and extension faculty incorporate practices to lower decay risk, including reduced fungicide usage, and identify high risk fruit lots and to market these before decay has time to develop in storage. \* Interaction of program components and the overall efficacy of various combinations of orchard, postharvest, and storage factors will be the guides to the description of programs for implementation in the pear industry. \* Determine packinghouse water system contamination by fungal pathogens. Commercial service lab can apply PCR technology to maintain sanitation determine most effective fungicides for each species. \* Customized decay control program for each unique pathogen complex.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

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

#### **Issue (Who cares and Why)**

When an invasive fruit fly was found in Mexico's important agricultural states, the Mexican government reached out to the experts at OSU's Spotted Wing Drosophila Project to help them deal with this new threat to fruit exports.

#### **What has been done**

SWD Project member, Linda Brewer of the OSU Department of Horticulture, consulted the experts at the OSU Technology Across the Curriculum to optimize a Spanish-language research review and protect agricultural interests across North America. The resulting presentation, funded entirely by the Mexican government, married an audience-appropriate pedagogy with interactive technology to present SWD research findings to state, national, and privately supported field advisors to the strawberry industry in the states of Michoacán and Jalisco and to convey species identification techniques for field workers.

#### **Results**

The effort was a resounding success, one that enhanced the Project's international reputation. The project included: 1) A dichotomous key poster helped field advisors learn how to visually identify Spotted Wing Drosophila; 2) A PowerPoint presentation walked participants through

project findings and posed pop quiz questions, which were announced by way of an old-fashioned desk bell, to the audience's delight; and 3) TurningPoint clickers added interactivity to the quizzes, slides, and audience discussion. Although twice as many people enrolled as anticipated, Brewer was able to facilitate lively audience discussion using clicker responses as a springboard. Visit the SWD website (<http://spottedwing.org/>) for information on how the project is performing research and developing resources to help the Pacific Northwest small fruit industry, growers, gardeners, and researchers manage this invasive fruit fly.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

#### Outcome #25

##### 1. Outcome Measures

A7 - Agricultural education produces the next generation of growers and educators

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

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

###### **Issue (Who cares and Why)**

: Students and the general population are losing touch with agriculture and critical issues facing agriculture and natural resources.

###### **What has been done**

To better prepare students for the world beyond school, a new course has been developed at OSU to introduce them to the structure and purpose of the Land Grant mission of education, extension and research. Students are provided an overview of the critical issues facing agriculture and natural resources industries through learning more about the Oregon system of Agricultural Experiment Stations. Weekly discussions will be led by faculty from OSU's Agricultural Experiment Stations located throughout Oregon and enriched by inclusion of key stakeholders representing industry and other agencies. One field trip to a selected OSU Agricultural Experiment Stations will be required.

#### **Results**

Students will be able to: 1) Identify and define important factors in a selected critical issues of Oregon agriculture and natural resources; 2) Explain the history and purpose of the Land Grant institution; and 3) Effectively communicate through short written and oral formats. Additionally, this course will enhance Bioresource Research, an interdisciplinary science program administered by the College of Agricultural Sciences. This 20-year old major offers research opportunities to undergraduates by requiring students to complete a thesis by graduation. They get to work with faculty mentors on unique research and ultimately write and present their findings at their thesis defense. Students have found tremendous success both in and out of school. 40% have graduated with honors and about 20% have graduated with an additional University Honors College degree. Graduates have a 100% success rate at either finding work within three months of graduating or getting accepted to a graduate program; about 60% go on to graduate school, many with full funding.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
216	Integrated Pest Management Systems

#### Outcome #26

##### 1. Outcome Measures

A6b - Consumer business knowledge leads to improved opportunities, survival, and profitability in food enterprises, as well as new and improved value-added products - New and existing businesses expand markets based on new understanding about market factors - Increased business activity and success in the Northwest food industries. - More successful starts by food businesses

##### 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)**

The food industry is very competitive. Profits are made or lost depending on consumer response to subtle differences in products and marketing. Sensory science provides an objective, experimental approach to measure consumer response towards particular products before they

go to market, providing real-life data that industries can use to guide their product development and marketing decisions. A recent consumer project asked if school children prefer hamburgers made from local Northwest-grown beef or pre-cooked standard-issue USDA patties.

**What has been done**

Ann Colonna, who runs the OSU Sensory Science Program at the Food Innovation Center (FIC), conducted taste tests. In the first experiment, she tested another group of school-age kids and found they could tell the difference between the two types of burger. A second experiment was set up to find out if the subjects had a preference for one or the other burger. The students were presented with two samples, identified with numbers, and are asked to examine and taste the burgers.

**Results**

FIC clients use test results to create people-oriented products. The results from the elementary school's burger preference test were not definitive. Votes split down the middle: half the kids preferred the USDA burgers (?it tasted like bacon?), and half preferred the Northwest beef (?it tasted like what we have at home?). The kids went home that day encouraged to think about why they're eating what they're eating. The results also were informative about the influence of taste experiences on food preferences.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
502	New and Improved Food Products

**Outcome #27**

**1. Outcome Measures**

1e - protection of natural environment from agricultural chemicals, for example: - Reduce the fate of agricultural chemicals in remote aquatic ecosystems - Improve policies or regulation of pesticides

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	1

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

**Issue (Who cares and Why)**

The highly contagious fire blight (*Erwinia amylovora*) disease affects pear and apple orchards throughout the western United States. In the state of Oregon, nearly 250,000 acres can be

negatively impacted by this pathogen, which causes affected plant tissue to appear blackened or scorched by fire.

**What has been done**

Johnson continues his research for alternative pathogen control in organic fruit orchards, of which there are nearly 20,000 acres in Oregon. Johnson has been using beneficial bacteria as pathogen control with good results.

**Results**

The work with non-antibiotic control has proven timely since a recent rule change by the National Organic Program removed antibiotics from the approved list for organic agriculture. This research should allow organic growers to transition to non-antibiotic programs for fire blight with a minimum of disease losses.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
216	Integrated Pest Management Systems

**Outcome #28**

**1. Outcome Measures**

4b - create new plant varieties for improved attributes

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
- Competing Public priorities
- Competing Programmatic Challenges

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**

We have seen significant improvement in irrigation practices, pest management, and sustainability of agricultural operations. Grower preferences for sustainable agricultural

practices is growing as is consumer demand for these practices. Breeding programs continue to produce cultivars with higher drought tolerance and lower demands for soil and fertilizer inputs.

**Key Items of Evaluation**

Research at OSU continues to promote improved agronomics that broaden grower opportunities at reduced costs and greater returns.