

Plan of Work

Annual Report of Accomplishments

Oregon Agricultural Experiment Station
Oregon State University

Federal Fiscal Year 2005



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FY2004 Annual Report of Accomplishments Oregon Agricultural Experiment Station

OVERVIEW

In this report, the Oregon Agricultural Experiment Station (OAES) will highlight a number of projects in each of the five major CSREES Goals and for twenty key theme areas. We provide summary outcome and impact information under individual key themes below. Those units which conducted the research are identified within each summary. The major selection criteria used are quantifiable outcome and impact.

Research results have been shared through refereed journal articles, abstracts, books and book chapters; theses, local, regional, national and international meetings, symposia and workshops; GIS climate, geophysical and plant maps; and a variety of web pages..

ASSESSMENT:

All units in the Oregon Agricultural Experiment Station are required to conduct annual performance evaluation of their faculty members. These annual reviews are conducted based on goals established during previous year's reviews. Since all faculty members with OAES FTE are required to establish station projects, annual performance evaluation serves as a good vehicle to assess our progress toward the goals in our plan of work. OAES has made good progress in meeting these goals. Over the next year, we plan to institute new output and outcome measures for reporting in preparation for the new Plan of Work reporting system.

ACCOUNTABILITY:

Additional information regarding research programs conducted through the Oregon Agricultural Experiment Station may be found in "*Oregon Invests*", a research accountability database accessible on the web at:

<http://oregoninvests.css.orst.edu>

There are currently over 330 reports contained in the database, searchable by selected criteria. Each report undergoes systematic professional review with analysis of projected economic, environmental and social effects, as appropriate. Examples of keyword search for each goal are:

Goal 1: disease resistance, pest management, genetics, irrigation, plant pathogens, genomes, biotechnology, sperm mobility, seafood processing, wheat cultivars, and pollination management.

Goal 2: fiber, food system, food quality, and food safety

Goal 3: human health, and human nutrition.

Goal 4: environment, waste management, biological control, biodiversity, endangered species, forest resources, climate change, integrated pest management, soil quality, sustainable agriculture, wildfire, and water quality.

Goal 5: rural, low-income families, community development, and employment.

A. PLANNED PROGRAMS

NATIONAL GOAL #1: An agricultural system that is highly competitive in the global economy. Through research and education, empower the agricultural system with knowledge that will improve the competitiveness in domestic production, processing, and marketing. We selected 27 projects from 10 key themes to highlight in this year's report.

TOTAL EXPENDITURES: \$34,292,446

Hatch:	\$1,236,791
Multistate:	\$544,208
State:	\$17,144,806
Other:\$	15,366,641

(other includes funds from sources such as grants, foundations, etc.)

TOTAL FTE FROM ALL SOURCES: 267.8

KEY THEMES

Key Theme: Adding Value to New and Old Agricultural Products

ISSUE OR PROBLEM

Maintaining profitability is an ongoing challenge in Oregon's farming sector due to constantly shifting commodity markets and shrinking profit margins. Oregon State University agricultural researchers help the state's agricultural producers meet this challenge by identifying and developing alternative crops with economic potential. According to OSU Agricultural Experiment Station scientists in southern Oregon, many industrial raw materials can be supplied by renewable, domestically grown, agricultural crops. However, very little is known about how to grow and process most of these under-used plant species. They are studying these promising, but poorly understood, alternative crops for possible use in the semi-arid climates of south central Oregon.

IMPACT

OSU crop scientists, like Richard Roseburg at Klamath Falls Experiment Station (ORE00489), anticipate that development of alternative crops such as poplar trees, native grasses, and oilseed crops will broaden the range of crops grown in the Klamath Basin. As an example, they are conducting studies with the alternative crop teff, which originated in Ethiopia and is used as a forage and grain crop. This will help stabilize the agricultural economy in the region, which is currently based on just a few crops grown there. In addition, some of these alternative crops may reduce demand for scarce water supplies in the Klamath area. In the case of teff, preliminary planting trial results stimulated a news article that appeared in the *Farmer-Stockman* magazine in Feb. 2005. Circulation of this article resulted in over 300 telephone call inquiries about teff from 41 states. This nationwide interest helped a local seed company sell over 5 tons of seed, resulting in about 2,000 acres of teff planted across the country.

Scope of Impact – State, regional, national

Source of Funding - Hatch, State, commodity funds

Key Theme: Agricultural Competitiveness

ISSUE OR PROBLEM-

Ecolabels have become an increasingly important information tool for agricultural industries desiring to inform consumers about the sustainable practices under which food products are grown and processed; and for consumers who want to know more about how food items are produced. OAES scientists are conducting marketing research to analyze the impact of ecolabeling on consumer choices to help agricultural producers understand the value of ecolabeling in retail markets as well as the benefits of adopting sustainable production practices.

IMPACT

Researchers, led by Cathy Durham at the Food Innovation Center (ORE00439), studied how consumers respond to ecolabeling information in making their product choices, and to analyze the effectiveness of ecolabels in enhancing retail demand. They collected retail sales and marketing data to test the effects of ecolabel marketing signage and messages. Then in Fall 2005, six focus group sessions were held in Oregon, Minnesota, and Rhode Island to explore consumer understanding of and response to various motivations for ecolabels and related marketing efforts. The preliminary results indicate differences in consumer's response to some ecolabel factors such as locale, family farm, and seasonality across regions. Findings are being used to design new point of purchase signage for ecolabels.

ISSUE OR PROBLEM

Fish stock assessments provide a foundation for fishery management decisions (e.g., catch quotas and fishing seasons) but are rarely able to provide highly accurate estimates of stock size or potential productivity. The purpose of the research project is to improve the quality, accuracy, and understanding of the stock assessment results and harvest management procedures that are used in the management of Oregon's fisheries for groundfish so that these fisheries can achieve greater economic benefits.

IMPACT

Significant costs may result from inaccurate stock assessments. If stock assessments underestimate the health or productivity of an exploited fish stock, then fishery management agencies may inadvertently set overly restrictive regulations that result in lost fishing opportunities and spill-over of displaced fishing activities. Conversely, if assessments are overly optimistic, harvests may be unsustainably large and result in stock declines and reduced long-term productivity. In recent years the Pacific Fishery Management Council has restricted marine commercial and recreational fishing along the U.S. West Coast because several rockfish stocks have been assessed as being depleted. Recent assessments for canary rockfish, for example, estimated that female spawning biomass has been less than 10% of its unexploited level, but a key assumption in the assessment is that a deficit of older female versus male canary rockfish, apparent in data from trawl surveys and trawl landings, is due to elevated rates of natural mortality for reproductive females. Working with fishing industry groups David Sampson of the Coastal Oregon Marine Experiment Station (ORE00123) collected canary rockfish from

untrawlable areas and found surpluses of females at numerous sites, which supports the idea that the relative lack of females could be an artifact of trawling rather than mortality. Also, he developed a new assessment for Dover sole that indicated the stock is much more productive than previously thought. Projections of sustainable harvests of Dover sole for 2007 and beyond are more than double the harvests allowed by the Council since 2001 when the stock was last assessed.

ISSUE OR PROBLEM

The Oregon fishing industry faces serious marketing and related policy issues. This project evaluates marketing and related policy issues for albacore and shrimp and develops information for standardizing product quality, increasing production of value-added products, and improving resource management. This year's work was to develop and test integrated marketing management systems from the vessel to the consumer and back to the vessel that incorporates traceability, product quality information, and value added products.

IMPACT

During 2005, Gil Sylvia of the Coastal Oregon Marine Experiment Station (ORE00526) and his colleagues pilot tested a complete traceability system for albacore tuna on environmental conditions, bycatch, product quality and handling, and location and date of harvests. This information was recorded and stored using bar codes and computers. They also developed a web page which links to the traceability information on individual fish which were processed as canned product. Work was also begun on a focus group methodology and designing user friendly traceability systems. When this project is completed they expect significant social and economic impacts related to new product and market development and improved business-related operations.

Additionally, a bioeconomic model was developed to evaluate management options and their effects on policy objectives including fishery yield, revenue, and net present value (NPV) in the Oregon ocean shrimp (*Pandalus jordani*) fishery. The base model accounted for a multiple cohort seasonal fishery, a count per pound catch composition, and an ex-vessel size-price relationship. The model identified optimal harvest strategies for ocean shrimp fishing by selecting the timing and intensity through 12 seasons of fishing effort. The base model was modified to incorporate extensions including recruitment selectivity, an integrated harvesting and processing sector, and a variable stock size consistent with historical recruitment. Results from the base model indicate that optimizing yield requires heavy early season effort to take advantage of relatively abundant age one shrimp. Conversely, when revenue or profit was optimized, season opening dates were delayed due to the economic value of larger shrimp and/or need to reduce costs. Modeling an integrated harvesting and processing sector reinforced the importance of managing temporal harvest strategies for maximizing revenue or profit objectives. Models based on historical recruitment suggested that foregoing fishing in poor recruitment years could lead to overall better performance by the fishery. Work next year will focus on the effects of variability of ocean recruitment and changing oceanographic conditions. Improving management of the shrimp industry by optimizing resource management including optimal timing and amount of industry fishing effort can have significant benefits for a fishery suffering from market pressures including low prices, high costs, and inadequate market development. Research to date indicates between 1-6 million dollars in additional economic impacts (net present value) due to improved management of the fishery by opening the season in June and eliminating

approximately one third of fishery effort. Ex-vessel and wholesale prices would be expected to increase by 10-20% and costs decreased by 30% or more. Eliminating fishing in years of low recruitment may generate up to \$2 million dollars in economic benefits

Scope of Impact – State, regional, national

Source of Funding - Hatch, State, Smith-Lever, commodity funds, USDA competitive grants

Key Theme: Agricultural Profitability

ISSUE OR PROBLEM

The need for economic input in policy decisions affecting the competitiveness of agriculture in the Pacific Northwest is of importance as U.S. exports have fallen since 1996. Meanwhile, imports have increased in value and as a share of US food consumption. This research work analyzes the market power-productivity-trade/FDI links and feedbacks using advances in theory, data and econometric methods.

IMPACT

The causal factors for the trade deficit in food industries include erosion in technological leadership, dollar appreciation, foreign affiliate activity of U.S. multinationals, slow down in the multilateral liberalization process and, in some cases, increases in foreign countries' agricultural protection through tariff and nontariff barriers. Research by Munisamy Gopinath of the Agricultural and Resource Economics Department (ORE00531) focuses on the first causal factor. He is testing the predictive ability of an analytical model to examine the consequences of productivity convergence using data from developed and developing countries, unlike earlier studies which focused exclusively on developed countries. As expected, the United States is the technological leader in several processed food industries, e.g., meat processing, fruits and vegetable processing, grain milling, but countries like Japan and Australia have achieved productivity levels similar to those of the US industries. Moreover, convergence to the US productivity level by other developed and developing countries appears to be relatively faster than that identified by previous studies. Average convergence rate across food industries is about 6 percent, which suggests that catching-up countries can double their productivity levels in less than 12 years. Effects of productivity convergence appear also in the narrowing of wage differences in food industries between the leader (the United States) and followers. The analytical model also predicts that the higher the rate of productivity convergence, the larger is the import share of leader's food consumption, a prediction consistent with the recent trend in US food imports and trade deficits. The analysis is likely to quantify the reversal in US food trade flows attributable to the erosion of technological leadership. By quantifying the effects of productivity on trade and the feedbacks, this research project has helped and continues to inform the public decision-making process. Policy options include supporting research and development activities, especially when markets fail to allocate resources due to free-riding and imitation (nonexcludability), trade remedies and safety nets.

ISSUE OR PROBLEM

The Mid-Columbia sweet cherry industry is undergoing a radical transformation in orchard production methods involving the use of recently available self-fertile cultivars,

dwarfing rootstocks and new tree training methods. The new emphasis is to produce fruit for the fresh market. We aim at developing production systems that will optimize high-quality fruit yields for maximum economic returns.

IMPACT

New water management findings by Roberto Nunez-Elisea at the Mid-Columbia Research and Extension Center (ORE00464) show great promise for increased profitability. Strategies include synthetic groundcovers to promote rapid tree growth and early yields, selective summer pruning to produce compact, precocious trees and protected cultivation in plastic tunnels. Significantly reducing irrigation rate below the amount indicated by soil moisture and ET monitoring data did not affect tree growth, production or fruit quality. Significant yield increases and high water use efficiency were achieved with synthetic fabric groundcover. Compact trees on non-dwarfing rootstock that produce large fruit can be obtained in 2 years by selective summer pruning of young trees; Such compact trees require less labor for pruning and harvesting and can be planted at densities double or triple those currently used. Studies also indicate the feasibility of producing high quality cherries with substantially less irrigation than is used traditionally in commercial orchards. Further, trees inside plastic tunnels will produce high pack-outs of premium quality Rainier fruit. These findings are gradually being integrated into new intensive and highly profitable (at least 40% more than current systems) high-density production systems for sweet cherries.

Scope of Impact – State, regional, national, and international

Source of Funding - Hatch, State, USDA competitive grants, Agricultural Research Foundation, commodity funds

Key Theme: Animal Health

ISSUE OR PROBLEM

Metabolic diseases such as pulmonary hypertension syndrome, cardiopulmonary disorders and sudden death syndrome (SDS) are the major cause of mortality in broiler chickens, and cost the U.S. poultry industry over \$100 million annually. The etiology and pathogenesis of metabolic diseases are not clearly understood, but have been attributed, at least in part, to intense genetic selection for fast growth rate, resulting in cardiac damage, failure of the cardiovascular system and death. Normal broiler diets are high in saturated and omega-6 fatty acids and are low in omega-3 fatty acids. This dietary imbalance may ultimately contribute to the development of conditions that predispose broiler birds to metabolic diseases. Understanding the role of maternal diet in modulating the lipid metabolism in progeny and characterization of the molecular mechanisms by which maternal fatty acids affects fatty acid metabolism in hatched chicks may increase our knowledge in controlling metabolic diseases and sudden death in broiler birds.

IMPACT

Studies by Gita Cherian of the Animal Science department (ORE00263) are showing a significant depletion of omega-3 (n-3) fatty acids in the tissues of birds dying due to SDS along with a reallocation of omega-6 (n-6) arachidonic acid in the heart and liver triacylglycerol. The alteration in saturated, mono and polyunsaturated fatty acid suggests an impairment in fatty acid

metabolism affecting the synthesis and tissue deposition of long chain n-3 and n-6 fatty acids in SDS birds. She also found that the content of n-3 fatty acids in the maternal diet can affect the ratio of n6:n-3 fatty acids in the tissue lipids of hatched chicks. The retention of n-3 fatty acids in chicks was evident up to day 35 of growth affecting the synthesis of proinflammatory eicosanoids. Findings will generate new knowledge about the fundamental relationship between maternal diet, fatty acid and eicosanoid metabolism and metabolic diseases. This will have important practical implications for improving bird health productivity and will bring increased economic returns to US poultry industry.

Scope of Impact – Regional and national

Source of Funding - Hatch, competitive, AHD

Key Theme: Animal Production Efficiency

ISSUE OR PROBLEM

Oregon's sheep numbers are declining due to several factors including marginal industry profitability. Increasing reproductive efficiency is the surest means of making U.S. lamb competitive with imported lamb.

IMPACT

Potential lamb production of prolific ewes is compromised by both high prenatal loss of embryos and lack of adequate milk to rear multiple lambs. This project by Howard Meyer of the Animal Sciences department (ORE00131) examines factors contributing to embryonic loss and the effect of East Friesian genes on increasing milk production. It is anticipated that results of this breeding and feeding study will show current producers how to increase productivity by 10% or more without significant change in production costs or management practices. Further, if sheep derived from the Dorper breed (which sheds its wool and is reputed to be very hardy) prove successful under pasture lambing conditions, producers may also be able to increase profit margins by reducing shearing and expensive indoor lambing costs.

Scope of Impact – State and regional

Source of Funding - Hatch, State

Key Theme: Biotechnology

ISSUE OR PROBLEM

Cottons are vulnerable to microbiological attack and degradation, but no currently used treatment method is both effective at destroying microorganisms and at the same time safe for the materials, user, and environment. The cotton industry finds the storage of raw cottons is somewhat problematic and the consumers would like to prevent the growth of mildew and odor on wet cotton clothing, especially in humid climates.

IMPACT

Hsiou-Lien Chen in the College of Health and Human Sciences (ORE00710) found that disinfestation using radiation such UV or infrared alone was found not effective in destroying the

mildew on cotton textiles, but the combination of high intensity UV lamps plus continuous infrared irradiation (i.e. three 265nm germicidal UV lamps plus infrared 800 nm heat lamp) for about 30 minutes were found to be effective in killing the mildew and destroying the spores. Although this disinfestation method may not be ideal for immediate commercial use, the findings from this project provide useful information to the cotton industry regarding the use of none destructive disinfestations method by combining UV and infrared radiations - UV radiation is germicidal while the infrared can selectively cause damage to the DNA in the mildew but will not affect the cotton cellulose.

Scope of Impact – National

Source of Funding - Hatch, State

Key Theme: Plant Genomics

ISSUE OR PROBLEM

The development of high yield and high quality potato varieties with resistance to biotic and abiotic stresses allows producing potatoes under more cost-effective, environmental-friendly and healthier conditions by using fewer inputs of chemical fertilizers, fungicides and insecticides and at the same time increasing the nutritional value and quality of the crop. Combining exceptional disease resistance with acceptable quality and yield remains a challenge.

IMPACT

In August of 2005 a new molecular genetics laboratory was added to the program and a new PI (M. Isabel Vales) with experience in plant breeding and genetics was hired to invigorate the current traditional potato breeding program with molecular breeding approaches. M. Isabel Vales, Steven James and Alvin Mosley of the Crop and Soil Science Department (ORE00436A) also coordinate activities at state, tri-state (in collaboration with Washington State University, University of Idaho and ARS efforts in Washington and Idaho) and western regional levels to develop varieties with improved yield and quality compared to varieties in greatest use at this time. The varieties Ranger Russet, Umatilla Russet, Alturas and Western Russet developed in this program are currently the 3rd, 16th, 18th and 19th most widely grown potato varieties in the United States.

Varieties recently released by the Tri-state program are now produced on over 110,000 acres with value to growers placed at approximately \$150 million. This value can increase up to 3 times after processing. In Oregon alone, in 2004, potatoes were planted in 37,000 acres, the total production was 19.8 mill cwt and the value was \$91.6 million. The Oregon breeding program has been estimated to return \$5.6 million annually to local and state economies.

The improved Umatilla Russet potato variety (a PVP release) yields 21percent more U.S. No. One grade potatoes than the older Russet Burbank variety under approximately the same fertilizer applications rates, and is immune to net necrosis, a potato tuber flesh blemish caused by leafroll virus infection. Umatilla is grown in more than 20 countries in which North American frozen processing companies operate. These improvements have resulted in an estimated additional \$7.9 million and \$8.4 million in farm gate value for Oregon growers in the 2004 and 2005 crops, respectively.

New potato varieties recently released include Blazer Russet, a dual purpose (processing and fresh market) oblong russet potato that is early maturing; and Defender, a light-skinned, high-yielding variety with late blight resistance. A program to develop potato varieties with exotic skin and flesh colors was begun in 2001.

ISSUE OR PROBLEM

Hazelnut is well-adapted to the Willamette Valley, but current leading cultivars have noticeable weaknesses including susceptibility to eastern filbert blight and poor suitability to the blanched kernel market. The purpose of this project is to develop new hazelnut cultivars and improve our understanding of hazelnut genetics.

IMPACT

Crosses in the hazelnut breeding program headed by Shawn Mehlenbacher of the Horticulture department (ORE00003) emphasize combining resistance to eastern filbert blight (EFB) with suitability to the blanched kernel market. 'Lewis' and 'Clark', recently released by the OSU hazelnut breeding program, are now the most widely planted cultivars in Oregon. The quantitative resistance of these two cultivars allows hazelnuts to be planted where eastern filbert blight is present, and acreage in the Willamette Valley has remained constant at nearly 30,000 acres. The kernel quality of 'Lewis' and 'Clark' will allow Oregon to compete effectively on the world kernel market. 'Santiam', the first cultivar with complete resistance to eastern filbert blight, was released in February 2005. Our understanding of hazelnut genetics continues to improve, as quantitative traits, Mendelian traits, and molecular markers are studied. Microsatellite loci have been developed and are now ready for use in germplasm characterization, including the identification of duplicates in the collection. RAPD markers identified in earlier research are now used by the breeding program in marker-assisted selection for eastern filbert blight resistance. Several new sources of resistance have been identified and used as parents in breeding. Growers are optimistic that new resistant cultivars will allow the Oregon hazelnut industry to remain competitive and eventually expand. Micropropagation is being used to rapidly multiply promising new selections.

ISSUE OR PROBLEM

The green bean processing industry in Oregon produces product valued at around \$20 million on about 18,000 acres. Processors rely on the high quality and high yielding bush blue lake types, which are very different from green beans used in the mid-western U.S. White mold is a fungal disease of dry and snap beans that can cause major field losses. Processors will reject loads at the cannery that have more than 3 percent infected pods.

IMPACT

James Myers, Horticulture, (ORE00381) is developing bush blue lake types with improved growth habit, yield and white mold resistance. Complete replacement of standard variety Oregon 91G (which is planted on about 80% of the acreage in Oregon) by OSU 5630 would be about \$16 million in annual value to processors. This does not take into account value to seed companies that maintain and sell the seed stocks, and to the retailers that sell the product to consumers.

Scope of Impact – State, regional, and national

Source of Funding - Hatch, State, USDA, other federal dollars, commodity groups

Key Theme: Plant Health

ISSUE OR PROBLEM

Alien weeds pose some of the most serious threats to agriculture and to biological diversity, and many are amenable to biological control using insects and pathogens. A conservative estimate of the economic impact of the twelve worst noxious weeds in the state is \$67 million annually. The purpose of the proposed work is to develop safe and effective biological controls for harmful non-indigenous plant species in the Pacific Northwest.

IMPACT

Oregon has the largest portfolio of biological weed control systems in the nation, numbering 71 control organism species for 31 weed species. Three of the 12 worst weeds (ragwort, purple loosestrife, and rush skeleton weed) currently have detailed research programs in the laboratory of Peter McEvoy (Environmental and Molecular Toxicology, ORE00010). Ragwort *Senecio jacobaea*, a weed of roadsides, pastures, and grasslands has been successfully controlled by biological methods. Assuming that at least half of the benefits calculated for controlling ragwort at its peak can be attributed to this research, then annual benefits to Oregon growers and livestock producers amount to \$3 million/year. Purple loosestrife *Lythrum salicaria*, an invader of wetlands, is being controlled by four introduced insect species distributed across invested sites in Oregon and the rest of the USA.

Classical weed biocontrol is subject to some of the strictest evaluations currently made in the United States for planned release of alien organisms. Nevertheless, there is increasing concern that biocontrol is often ineffective or possibly unsafe. In February 2005, McEvoy outlined research to support a Code of Best Practices for Biological Weed Control.

ISSUE OR PROBLEM

Orchard diseases and postharvest decay of tree fruits continue to be major industry concerns in Oregon. The purpose of this research is to develop effective integrated control procedures for major preharvest and postharvest diseases of tree fruits in the Pacific Northwest.

IMPACT

This study by Robert Spotts at Mid-Columbia Research and Extension Center (ORE00426) has identified pear cultivars that may be grown without chemical pear scab and powdery mildew control, and that may be useful as parents in breeding for resistance. Also, weather station networks are being augmented, pear scab model validation research conducted, and new GIS and web delivery technologies developed for successful implementation of the scab model. This will benefit pear growers throughout the Pacific Northwest with timely, accurate risk prediction for pear scab, resulting in maximum control at minimum cost. Fungicide usage has been reduced by over 50% thus far.

ISSUE OR PROBLEM

Fire blight is the most serious bacterial disease of pear and apple trees in Oregon's multi-million dollar pear and apple industry. During severe epidemics of the disease entire orchards

may be affected. Researchers are studying ways to improve biological treatments for the disease that offer much greater control than chemical sprays currently in use by growers.

IMPACT

In western states growers typically use multiple sprays of antibiotic treatments or biocontrol bacterium agents for disease management. However these products reduce the incidence of disease by less than 50 percent. The new fire-blight control program developed by researchers, including Kenneth Johnson of the Botany and Plant Pathology (ORE00294), using iron-enhanced biological technology reduced the incidence of fire blight by 70 percent. This integrated strategy provided superior disease control in orchard trials and reduced the number of antibiotic treatments needed for disease suppression. The new disease management approach will give growers a more effective tool for suppression of fire blight in pear and apple crops.

Scope of Impact – State, regional, national, and international

Source of Funding - Hatch, State, Oregon Department of Agriculture, U.S. Forest Service, Bureau of Land Management, other federal dollars, commodity funds

Key Theme: Plant Production Efficiency

ISSUE OR PROBLEM

A large proportion of potato production acreage in the Pacific Northwest is at risk from quality defects caused by nematode diseases that cause potato crops to be rejected. Current practices use large amounts of expensive soil fumigants. This project will investigate chemical control strategies to achieve acceptable quality with less and/or more economical pesticide inputs. It will develop cultural strategies that suppress nematodes before potato is planted so that further-reduced levels or no nematicide additions are necessary.

IMPACT In the Columbia Basin of Oregon,

Russell Ingham of Botany and Plant Pathology (ORE00259A) made different applications of Vydate C-LV to evaluate treatment times on suppression of potato tuber damage from Columbia root-knot nematode (*Meloidogyne chitwoodi*, CRKN). All Vydate treatment schedules significantly reduced populations of CRKN and stubby-root nematode at harvest in the Columbia and Klamath Basins of Oregon.

ISSUE OR PROBLEM

A large proportion of potato production acreage in the Pacific Northwest is at risk from quality defects caused by diseases and pests that cause potato crops to be rejected. This project develops agronomically efficient, high-yielding potato varieties with resistance to diseases, viruses, insects and environmental stresses for frozen processing, fresh market and chipping uses, screens exotic and domestic germplasm for resistance to powdery scab, and evaluates chemical compounds for efficacy in controlling root and tuber field infections of powdery scab caused by *Spongospora subterranea*.

IMPACT

A cooperative program to develop new potato varieties for the Pacific Northwest potato industry was conducted by Steven James at Central Oregon Agricultural Research Center

(ORE00389) during 2005. Potato germplasm screening, potato variety trials and seed increases for future trials were major endeavors of the research program. A new variety, Umatilla Russet, yields 21% more U.S. No. Ones than Russet Burbank under approximately the same fertilizer regime, has 10% less hollow heart/brown center than Russet Burbank and is immune to net necrosis, a tuber flesh blemish caused by leafroll virus infection. Seed of Umatilla Russet sells at a \$1.00/cwt premium to Russet Burbank. These improvements have resulted in an estimated additional \$7.9 million and \$8.4 million in farm gate value for the 2004 and 2005 crops, respectively. Production of specialty potatoes will result in new products with positive benefits to human health and increased market share. New cultivars with resistance to nematodes, late blight and PVY resistance will result in less pesticide usage and lower production inputs. Cultivars with resistance to Columbia root knot nematode could save growers fumigation costs of \$200 to \$400 per acre. Seed acreage of Oregon-sponsored new potato variety releases include Mazama (9 acres of seed grown in 2005), Modoc (15 acres) and Ivory Crisp (207 acres). Improvements in farm gate receipts are expected when seed of these new varieties are planted in the spring of 2006.

ISSUE OR PROBLEM

Potato growers in the Treasure Valley of eastern Oregon and southwestern Idaho face significant challenges to sustainable production. In the PNW, potatoes are produced with high nitrogen fertilizer and irrigation inputs leading to nitrate leaching. Low nitrate leaching loss under Russet Burbank is complicated because of sensitivity to yield and quality losses with water stress and nitrogen deficiency. Research and demonstrations attempt to discover alternative ways to grow potatoes with drip irrigation to protect economic yield as well as groundwater resources. Conversion to drip irrigation raises growers' concerns about the best management practices associated with production under drip, e.g., potential changes in the crop canopy and soil environments, with potential physiological plant responses and disease development implications.

IMPACT

Irrigation, fertility, and disease management options were examined for potato by Clint Shock at the Malheur Experiment Station (ORE00310). Although mean total yield for Umatilla and Ranger Russet cultivars was not influenced by the water stress treatments tested, marketable yield and total yield of U.S. No. 1 tubers were significantly affected by a single episode of water stress during tuber bulking. Ranger Russet had the highest total U.S. No. 1 yields. Stress substantially reduced the percentage of U.S. No. 1 and over-12-oz tubers, with Ranger Russet showing pronounced losses to water stress. Production of marketable tubers for processing (which comprises total U.S. No. 1 plus U.S. No. 2 grades) was significantly affected by a single missed irrigation for both potato cultivars. A single episode of water stress during tuber bulking brought about a reduction of 4.5 percent and 26.0 percent on marketable yield of Umatilla Russet and Ranger Russet, respectively. Although not significant, a slight tendency toward reduced specific gravity was observed for Ranger Russet due to a single episode of water stress during tuber bulking. Tuber length to width ratio was significantly affected by a single episode of stress, with a reduction of about 2 and 9 percent for Umatilla Russet and Ranger Russet, respectively.

ISSUE OR PROBLEM

The Pacific Northwest needs new wheat varieties with superior disease and insect resistance and enhanced stress tolerances that minimize production risks, increase economic returns to growers, promote adoption of sustainable farming practices, and increase demand and marketability of PNW wheat. Further, demand for hard white wheat continues to increase in Asian markets. To become a reliable grain supplier, large acreages of U.S. hard red and soft white wheat will need to be replaced with hard white cultivars. U.S. quality targets for hard white wheat are grain of minimum 12.5% protein that produces low ash flour with moderate to high starch viscosity, high color stability, and moderately strong and extensible dough.

IMPACT

Genetic improvement of wheat varieties contributes directly to increased production efficiency for wheat growers. The soft white wheat variety ORSS-1757 was developed and released in 2005. Noted for its superior milling and baking quality, ORSS-1757 was exclusively licensed to industry to promote identity preserved grain production and marketing of the variety. Through this mechanism, Oregon growers and industry will have means to capture value from the superior end-use quality of ORSS-1757 by marketing direct to quality-conscious customers.

Wheat growers also face serious economic losses each year because of widespread infestations of grassy weeds which reduce both grain yield and grain quality. Jim Peterson and his colleagues in Crop and Soil Science (ORE00035A) developed and released two CLEARFIELD herbicide-resistant wheat varieties, ORCF-101 and ORCF-102, in collaboration with BASF Corporation. These varieties, when used in combination with Beyond herbicide, will reduce economic losses from grassy weeds, increase management options, increase grain quality, and further increase production efficiency. Eighteen seed companies have now been licensed to produce and sell seed of OSU-developed CLEARFIELD varieties in the Pacific Northwest. Over 200,000 acres of ORCF-101 were grown in 2005. For 2006, combined acreage of ORCF-101 and ORCF-102 in the Pacific Northwest is anticipated to be over 350,000 acres.

For hard wheat trials, significant variation in protein content, protein quality, and dough rheological properties were observed among cultivars, irrigation levels, and fertilization rates. The main effects of irrigation and soil N had had relatively little direct impact on protein composition or PPO activity. Cultivars of similar protein quality and composition responded similarly to the N and stress treatments. This reinforces the importance of crop management strategies, in addition to variety selection, to reach desired marketing targets for grain protein, flour quality, and end- product performance.

ISSUE OR PROBLEM

Loss of seed due to shattering is one of the major causes of low and unpredictable seed yields in cool-season perennial grasses. Very little information is available for managing irrigation in grass seed crops.

IMPACT

Using a custom-designed linear irrigation system, Tom Chastain in Crop and Soil Science (ORE00430) was able to demonstrate that timely spring irrigation is an economically viable practice in perennial ryegrass and tall fescue seed production. In tall fescue, seed yield was increased by up to 38% with irrigation in four of the six cultivars evaluated. In perennial ryegrass, seed yield was increased up to 21% with irrigation. Timing the irrigation to fill the soil profile once produced seed yield results similar to frequent irrigation to prevent water stress but with less water used. A spring nitrogen x cultivar interaction was evident in winter canola seed

yield in 2005. All cultivars responded to a topdressing of 56 kg N/hectare with increased seed yield, but some cultivars benefited more by an additional 56 kg N/hectare (112 kg total spring N) than did others. Yields of Athena, UIC 02.2, UIC 3.1 were highest with 100 lbs spring N/acre while yields of Baldur, Ceres, and Kronos were equal at 56 and 112 kg spring N/hectare. Maximum yield of all cultivars exceeded 4,480 kg/hectare.

ISSUE OR PROBLEM

Plants utilized in the most productive and least damaging manner is prudent. Land managers want to wisely select plants. Currently, putting the right plant into the right place is difficult. An abundance of knowledge is available and better selection can be aided with better selection tools, such as web-based information and Decision Support Systems (DSS).

IMPACT

This forage species mapping and DSS project by David Hannaway (ORE00324) in Crop and Soil Science produces maps of cultivated forage species based on quantitative tolerances to climate and soil conditions and placing them in various web-based information systems. This involves collaboration with climate modeling and mapping experts, soil scientists, and ecophysiologicalists from the USA, China, Australia, Thailand, and Viet Nam. Funding was provided by the USDA Foreign Agricultural Service Emerging Market Program between 2000 and 2004 to support the PRC data accumulation, modeling, and mapping portion of the project. Spatial mapping of the climate of the USA and China has been accomplished at a 4 km grid cell level of resolution. A China Map Atlas was completed in 2005 and will be provided to donors and key cooperators. Specifically, as part of a larger USDA FAS Market Access Program project with the Oregon Seed Council, this research project has helped to improve sales of US-grown cool season grass seed into China; from near-zero in 1993 to over 8 million pounds in 2004. Professional development, improvement of teaching, and improved international relations is occurring due to the collaboration of dozens of scientists from several countries with a wide spectrum of scientific backgrounds and expertise. A web segment has been drafted to deliver the decision support necessary for optimal species selection. This segment will be added to the newly re-designed Forage Information System.

ISSUE OR PROBLEM

Winter annual grass weeds are the most troublesome weeds in dryland winter wheat cropping systems. This project by Dan Ball (ORE00242A) at the Columbia Basin Agricultural Research Center develops management practices to control winter annual grass weeds in wheat and minimize problems with herbicide resistant weeds.

IMPACT

Winter annual grass weeds such as jointed goatgrass, downy brome, feral rye, wild oat, and Italian ryegrass have the same life-cycle as winter wheat and are difficult to control in conventional wheat production systems. Plant breeders are developing imidazolinone-resistant winter wheat varieties adapted to a range of Pacific Northwest production regions. It is estimated that in 2005, approximately 400,000 acres of CLEARFIELD wheat will be planted in the Pacific Northwest. Control of jointed goatgrass, feral rye, or volunteer cereals in winter wheat is now possible with this technology and will lead to a minimum 5% yield increase, and reduced dockage of 0.5% in more than half of these acres. Positive environmental benefits from improved control techniques include decreased use of herbicides, reduced nitrogen fertilizer loss from

agricultural soils, and less herbicide drift and soil residue loss. In some cases where an increase in herbicide applications is needed, no adverse environmental impact is likely. Meanwhile, consideration must be given to public negative perceptions about herbicide use. Reduced soil erosion results from farmer adoption of recommendations from this project. This lowers county/state maintenance costs for road and ditch repair. Reduced herbicide use translates to less drift and associated damage to off-site agricultural crops, ornamentals, and nonfarm neighboring property. Overall, the recommended management changes also result in an improved public image of agriculture

ISSUE OR PROBLEM

Oregon has a unique growing environment for vegetable production. Many vegetable varieties developed elsewhere are not adapted to the climate or the pests and diseases that may be a problem in Oregon, but nowhere else in the U.S. For adapted and productive varieties, breeding must be done in the environment for which the vegetable varieties are intended.

IMPACT

Oregon has a processed vegetable industry worth about \$51 million per year, while fresh market production receives about \$110 million to annually. In 2005 observation trials were conducted by James Myers (ORE00049A) of Horticulture for a wide range of vegetables to determine adaptation to Western Oregon. Work was also reported through multistate projects. A recent release, 'Legend' tomato is being distributed by seven seed companies nationally in the U.S., and by two companies in England. New stringless snap pea varieties may find use in the world fresh market production areas of Central America and Africa. New virus resistant 'Golden Delicious' type winter squash will aid processors and culinary seed producers.

ISSUE OR PROBLEM

With the exception of blueberries, where about 42% of the crop is marketed fresh, over 90% of Oregon's berry crops are processed. In 1994, the value of berry crops added by handling or processing was estimated at \$178 million; in 2004 this would be estimated at \$220 million. Oregon ranks among the top four states in production of strawberries, red and black raspberries, and blackberries. Oregon berry crops are noted for their high quality, including color, flavor, and texture. The processed value of berry crops and grapes between 1985 and 1993 increased 78%. To remain competitive, especially in a global market, Oregon berry growers must continue to produce a high quality product. Industry goals, to develop cultivars that are relatively pest resistant and produce good yields of a high quality fruit for processing and/or fresh market match the goals of this project. Development of new cultivars that maintain or improve on industry standards for yield and quality is a key goal. Understanding what factors control yield and quality and how they might be manipulated through production systems or breeding is also a goal.

IMPACT

The objectives of this USDA-ARS/OSU cooperative project by Bernadine Strik with Chad Finn, ARS geneticist (ORE00315), at North Willamette Research and Extension Center are to develop new blackberry, raspberry and strawberry cultivars for the Pacific Northwest with traits such as improved yield, thornlessness, better winter tolerance, suitability for machine harvest, and high fruit quality. Cooperation from university and research personnel at Washington State University and Agriculture Canada, Agassiz, British Columbia continued.

Tillamook accounted for 11% of the acreage of strawberry planted in the Pacific Northwest in 2005. Obsidian and Metolius blackberry are suited for early-season fresh market and are being planted by commercial growers. Black Pearl, Nightfall, and Black Diamond blackberry are for the processed market with the latter cultivar already accounting for over 20% of blackberry plant sales in 2005. The release of the thornless blackberry cultivars for processing is expected to have a large impact in our industry as there can be a problem with thorn contamination in machine-harvested thorny cultivars like Marion. The new blueberry cultivars from Michigan State University, tested here in Oregon in this program, are in very high demand by growers and will have a large impact on the late-season fresh market and command a premium price. We continue to measure impacts from our earlier released cultivars; for example, Coho red raspberry continues to be planted (100 acres in 2005) and can enjoy a \$0.40 to \$0.70/lb premium for the fresh market, an estimated impact of [200 acres planted x 6,000 lb/acre x premium] = \$480,000 to \$840,000 per year. Siskiyou and Obsidian had an average \$.80 premium/lb and an impact of about \$1.9 million.

ISSUE OR PROBLEM

More scientific knowledge is needed to optimize wine grape production and fruit quality in Oregon. This project will provide scientific background for optimizing cultural practices for the implementation of Integrated Production of grapes. Research will be focused on grapevine irrigation and nutrition, evaluation of phylloxera-resistant rootstocks, manipulation of carbon production and allocation to advance the onset of ripening, and optimization of fruit composition to improve the commercial viability of the Oregon wine grape industry.

IMPACT

Rootstock research by Carmo Vasconcelos (ORE00455) of the Horticulture department showed that the rootstocks most commonly used in Oregon are not the most appropriate for its growing conditions. Some of the new rootstocks showed increased drought tolerance, maintained photosynthesis during the hot summer months, and generated four times higher yields of similar or higher quality as compared to those currently being used. Fruit and wine composition can be modified by rootstock. The wine originating from vines grafted to 110R (one of the new rootstocks) was preferred over the three traditional rootstocks used in Oregon. Using these new rootstocks has the potential of increasing growers revenues by five fold, improve wine quality, while decreasing production costs related to the use of irrigation required by some drought sensitive rootstocks. Our experiments with irrigation of mature vines showed that irrigation in the Willamette Valley is not required every season. It also showed that water status during previous seasons impacts the vines in the seasons that follow. To achieve sustainable productions of the highest quality, vine water status should be continuously monitored and supplemental irrigation should be provided in seasons of drought.

ISSUE OR PROBLEM

Nitrogen use efficiency under surface broadcasting of dry nitrogen (N) fertilizers to the soil surface has been reported to be low in tree fruit production systems in the Pacific Northwest. Drip irrigation systems will be evaluated on pear and sweet cherry orchards and the guidelines about N fertilization and drip irrigation as an integrated production system will be developed.

IMPACT

Nitrogen and water use are both inefficient on orchards in the Mid-Columbia region, which has resulted in excessive N and water consumption, increased production costs, reduced fruit quality, and contaminated water. This project by Xinhua Yin (ORE00125) at the Mid Columbia Research and Extension Center compared two different N and water management systems (fertigation of N fertilizer through drip irrigation, broadcasting application of dry N fertilizer to soil surface under micro-sprinkler irrigation) under different pear cultivars and rootstocks. Different N application rates and timings were evaluated on Anjou pears. Two irrigation systems and four ground cover systems were evaluated on sweet cherry. The integrated N fertigation and drip irrigation system seems to be an effective replacement to our current N and water management system. Nitrogen fertilizer and water consumption was reduced by 20% and 73%, respectively, using the integrated N fertigation and drip irrigation system compared with our current system. Fruit yield and quality were comparable under these two production systems. The profitability of each system has not been calculated; however, the researchers believe that the N fertigation and drip irrigation system will be more profitable. Additionally, the current N application rates used by growers could be reduced significantly. Drip irrigation saved 74% of water; which could reduce orchard nitrate leaching.

Scope of Impact – State, regional, national, and international

Source of Funding - Hatch, State, Oregon Department of Agriculture, USDA competitive grants, other federal dollars, commodity funds

Key Themes: Rangeland and Pasture Management

ISSUE OR PROBLEM

The establishment and spread of non-native weeds, along with overgrazing, has degraded rangelands of the western United States and dramatically increased the danger of wildfires on these lands. Scientists are studying ways to restore rangeland ecosystems by reintroducing native plant species. Displacement of weeds by native vegetation will enhance forage production, wildlife habitat and watershed health on rangelands while reducing the danger of wildfire.

IMPACT

Researchers, including Paul Doescher of OSU (ORE00901A) are studying how non-native weeds compete with native plant species and how these weeds interact with soils and climate as they grow. Collaborators in the project include scientists and land managers from Utah State University, University of Nevada- Reno, Natural Resource Conservation Service, U.S. Geological Survey, U.S. Forest Service, Agricultural Research Service and Bureau of Land Management. The research team is also studying various approaches to re-seeding native plants on damaged rangeland sites to identify the most successful seeding strategies. Researchers are assessing collections of native plants found throughout the Great Basin to evaluate and select the best plants for re-seeding. Trials are underway at sites in Nevada, Utah, Idaho and Oregon.

To date, researchers cooperating on this project have established a series of experiments across the Great Basin region designed to assess various native plant species for their suitability in restoring weed infested rangelands. Evaluations of species response will continue for the next several years. In an associated project, researchers analyzed application strategies that limit soil

nitrogen that may give native vegetation a competitive advantage over non-native annual grasses. A new project started in 2005 will focus on a comprehensive 5-year study that will evaluate the effects of fire and various fire treatments intended to reduce wildfire fuels and restore native species diversity.

Scope of Impact – State, regional, national

Source of Funding - Hatch, State, USDA/CSREES, U.S. Forest Service, Agricultural Research Service, Bureau of Land Management, U.S. Geological Service

NATIONAL GOAL #2: A safe and secure food and fiber system. To ensure an adequate food and fiber supply and food safety through improved science-based detection, surveillance, prevention, and education. We selected 3 projects from 2 key themes to highlight in this year's report.

<i>Total Expenditures:</i>	\$3,121,319
Hatch:	\$136,683
Multistate:	\$17,981
State:	\$2,107,140
Other:\$	859,515
(other includes funds from sources such as grants, foundations, etc.)	

TOTAL FTE FROM ALL SOURCES: 23.3

KEY THEMES

Key Themes: Food Quality

ISSUE OR PROBLEM

Oregon's coastal communities have endured tough times over the past several years due to volatile shifts in fisheries economies. Our scientists are working to give the coastal economy a boost through new seafood product research and development.

IMPACT

Michael Morrissey and Gil Sylvia of the Coastal Oregon Marine Experiment Station (ORE00484A) in collaboration with Shorebank Enterprises developed an approach called the Stage Gate process to critically assess value-added products during different stages of development. This method is divided into a series of five steps including 1) idea generation, 2) opportunity identification, 3) product concept development and feasibility, 4) total product offering and 5) product launch. The process is designed so that at each step key questions must be answered before the product can continue onto the next stage. Gate-keepers determine whether the stage criteria have been met. The gate-keeper team includes a seafood scientist, a resource/ marketing economist, a marketing specialist and a product development/industry specialist. Some of the new value-added products currently at various stages in the process are microwaveable Manila clams, shelf-stable albacore tuna packed in olive oil, and fish jerky made from salmon trim waste.

The development of the stage-gate process offers small and mid-size businesses and entrepreneurs a systematic method of following a product through from conception to launch. A key feature is the multi-disciplinary product development team that critically assesses value-added seafood products during their development. This step-by-step approach will provide more opportunities for small seafood businesses to engage in the development of value-added products. During the past year 10 products have entered the Stage Gate process and researchers expect that this number will rapidly increase as more products undergo commercial launch.

ISSUE OR PROBLEM

The sales of fresh-cut produce reached \$10 billion in the U.S. market in 1999. Although many pre-cut vegetables and salad mixes are available, development of comparable fruit products has not been prevalent largely due to the susceptibility of cut fruits to enzymatic browning and texture defects which limit product quality and shelf-life. The purpose of this study is to improve shelf-life and to enhance the health benefits of fresh-cut fruits by preventing surface discoloration, maintaining or manipulating texture quality, improving microbial safety, and increasing the health benefits of fresh-cut fruits. These efforts would significantly increase the market values of these products and improve public health. By enriching the nutrients that are lack or low in fruits would increase the intake of these nutrients, encourage the consumption of fruits, hence improving public health.

IMPACT

Studies by Yanyun Zhao of Food Science and Technology (ORE00433) evaluated the quality of nutritionally fortified strawberries and fresh-cut apples by use of edible coating and vacuum impregnation (VI) technologies, as well as evaluated the bioavailability of vitamin E fortified fresh-cut apples. The sensory quality of fresh strawberries coated with vitamin E fortified edible coatings was evaluated. Three 1% chitosan-based solutions were developed for coating strawberries. Chitosan coatings increased the appearance acceptance of the strawberries, but coatings containing vitamin E decreased acceptable appearance of strawberries. Chitosan coatings did not change consumer acceptability of flavor, sweetness, or firmness of the samples.

Nutritional, sensory and physiochemical properties of fresh-cut apples (Fuji) fortified with vitamin E and minerals by use of vacuum impregnation (VI) were studied. Vitamin E content increased more than 100 times, and calcium and zinc contents increased about 20 times in comparison with unfortified apples. Consumer sensory study demonstrated that treated apples were highly accepted by consumers in respect to overall liking, color and texture quality. Bacterial growth was concurrently detected in all apples, but the total plate accounts were under 2.6 log CFU/g apple at the end of 7 days of storage, significantly lower than the industrial standard.

Scope of Impact – State, regional, national, and international

Source of Funding - Hatch, State, USDA grants, Oregon Economic Development Department, U.S. Economic Development Agency, Oregon Department of Agriculture, National Marine Fisheries Service, Agricultural Research Foundation, Kellogg Foundation, commodity funds

Key Themes: Food Safety

ISSUE OR PROBLEM

Contamination of fresh fruits with potentially life-threatening pathogens is a major food safety problem. Currently, there is an urgent need for determining the modes of contamination, developing intervention strategies to destroy pathogens in fresh and processed fruits, and delivering relevant information to farmers and processors.

The long-term goal of this project is to enhance and ensure the safety of Northwest fresh berries and their products including juice and puree. In addition we will implement training and education programs for berry farmers and juice processors. Promoting an awareness of the potential microbial hazards associated with the cultivation and processing of berry fruits will result in growers/processors implementing specific Good Agricultural Practices, Standard sanitation Operating Practices and HACCP. The development of specific intervention processing technologies will provide mechanisms to ensure not only safe products but also products of the highest nutritional value and of desirable sensory characteristics.

IMPACT

Mark Daeschel and Yanyun Zhao of Food Science and Technology (ORE00708) evaluated the ability of acid resistant strains of *E. coli* O157:H7 and *Salmonella typhimurium* to survive in non pasteurized juice products from blueberry, raspberry, strawberry, blackberry and table grapes. They observed that pathogens such as Salmonella and *E. coli* can survive for short periods of time if introduced into berry juices or purees. This would be of greatest concern with fresh juice products that are not processed to assure a 5-log reduction and are destined for immediate consumption. They also evaluated the effectiveness of lysozyme/chitosan coatings to retard the growth of spoilage molds on fresh fruits. Results showed that there was no significant synergistic inhibitory effect between chitosan and potassium sorbate on fungal growth on fresh strawberries. However, significant synergistic inhibition activity was observed in vitro test when potassium sorbate was added into the chitosan formulation. Antifungal activity of chitosan against *Cladosporium* sp. and *Rhizopus* sp. was not affected by the autoclaving process of coating solutions. Coating treatment also reduced total plate count, coliforms, and weight loss of strawberries during storage. These observations will allow us to develop practical approaches using coating technologies to inhibit microorganisms on fruit surfaces thus further ensuring quality and safety

Scope of Impact – State, regional, national, and international

Source of Funding - Hatch, State

NATIONAL GOAL #3: A healthy, well-nourished population. Through research and education on nutrition and development of more nutritious foods, enable people to make health promoting choices. We selected 3 projects from 2 key themes to highlight in this year's report.

TOTAL EXPENDITURES: \$4,081,115

Hatch: \$35,354

Multistate: \$72,569

State: \$1,088,838

Other: \$2,884,354

(other includes funds from sources such as grants, foundations, etc.)

TOTAL FTE FROM ALL SOURCES: 30.1

KEY THEMES

Key Themes: Human Health

ISSUE OR PROBLEM

Each year 500,000 persons in the United States die from cancer. Although epidemiologists have linked one-third of these deaths to dietary imbalances, the specific factors in our foods that may provide protection against this disease, or increase the risk of developing the disease, are not well understood. This project will examine the dose-response efficacy and molecular mechanisms by which three classes of food-borne phytochemicals -- indoles, chlorophylls, tea antioxidants -- protect against cancer in experimental animals and humans.

IMPACT

Liver cancer is the third leading cause of cancer death worldwide, the most rapidly increasing cancer in the US. Since this devastating disease is often refractory to surgical or chemotherapeutic intervention, it is especially important to identify means of preventing the disease at the outset, rather than hoping only for improved cure rates. George Bailey and colleagues in Environmental and Molecular Toxicology (ORE00108A) have determined for the first time that the natural phytochemical chlorophyll is highly effective at blocking liver cancer initiation in rat liver by the potent mycotoxin AFB1, and in the trout by the potent combustion product dibenzo(a,l)pyrene. Chlorophyll protection was as great as that seen by its water soluble derivative chlorophyllin, with 50% tumor reduction at levels a fraction of the chlorophyll content of spinach. These are the first studies in any animal model to demonstrate potent tumor blocking activity by the ubiquitous green plant phytochemical chlorophyll, and at doses easily within the Chl content of spinach. This finding has enormous implications for people in parts of Asia and Africa, where as many as 10% of adults may die of aflatoxin-related liver cancer by age 45.

ISSUE OR PROBLEM

Cancer is the second leading cause of death in the U.S., with about 550,000 deaths annually and over 107 billion dollars in health care costs. Up to 35% of all cancers may be

prevented by diet. Epidemiology studies confirm that individuals consuming diets with high amounts of fruits and vegetables can reduce their risk of many cancers in half, yet many individuals do not consume this level of phytochemicals in their diet. For these individuals, supplementation with these phytochemicals in pill form is an option and has become a multi-billion dollar industry. However, little or no information is available on the risks/benefits of such supplementation for pregnant women with respect to the health of the fetus. The fetus is very susceptible to cancer caused by exposure to chemicals during pregnancy.

IMPACT

This project by Williams of Environmental and Molecular Toxicology (ORE00728) examines the potential for three of the major phytochemicals (indole-3-carbinol (I3C) from cruciferous vegetables, polyphenols found in teas, and chlorophylls from green and leafy vegetables) known to prevent cancer in protection of the fetus against liver and lung cancer caused by maternal exposure to chemical carcinogens known as polycyclic aromatic hydrocarbons (tobacco smoke, diesel exhaust, etc.). For the first time, we have shown that modulation of the maternal diet with chemoprotective phytochemicals, such as I3C from cruciferous vegetables, can provide significant protection for the fetus against such transplacental carcinogens.

Scope of Impact – State, regional, national, and international

Source of Funding - Hatch, State, USDA, other federal funds, contracts and grants, private funds

Key Themes: Human Nutrition

ISSUE OR PROBLEM

A large body of evidence suggests that a significant percentage of deaths resulting from cancer in the US could be avoided through greater attention to proper and adequate nutrition. This project determine the mechanisms by which zinc deficiency increases risk for DNA damage and cancer.

IMPACT

Data from this project by Emily Ho (ORE00735) from the College of Health and Human Sciences suggest an important function of zinc could be to protect the cell from DNA damage and oxidative stress. Inadequate consumption of zinc and subsequent zinc deficiency will provide an environment for increased DNA damage, inability to respond stress and risk for cancer. Over 70% of Americans are not getting the recommended level of zinc. This research addresses the importance of getting adequate zinc from zinc-rich foods to improve health. Secondly, a reliable test for zinc deficiency in humans does not currently exist. The molecular approaches used in this project may reveal unique gene expression changes with zinc deficiency and provide a more reliable marker for zinc deficiency in humans. Thus, this research will aid in improving the health of Oregonians and the U.S. population as a whole.

Scope of Impact – State, regional, national, and international

Source of Funding - Hatch, State, National Institutes of Health, Linus Pauling Institute, USDA,

NATIONAL GOAL #4: Greater harmony between agriculture and the environment.

Enhance the quality of the environment through better understanding of and building on agriculture's and forestry's complex links with soil, water, air, and biotic resources. We selected 8 projects from 5 key themes to highlight in this year's report.

TOTAL EXPENDITURES: \$14,500,616

Hatch:	\$321,945
Multistate:	\$216,096
State:	\$4,638,008
Other:	\$9,324,567

(other includes funds from sources such as grants, foundations, etc.)

TOTAL FTE: 130.7

Key Themes: Biodiversity

ISSUE OR PROBLEM

Most microorganisms in nature are new species which have never been cultured or studied in laboratories. Understanding these organisms is the key to understanding geochemical cycles and the discovery of new pharmaceuticals. The purpose of this project is to isolate new microorganisms.

IMPACT

Work from the Steve Giovannoni lab (ORE00402) in the Microbiology department has had a significant, broad impact on microbiology. They have developed very successful strategies to isolate microorganisms that previously could not be cultured. They have shown that these organisms can be cultured with conditions that approximate the natural environment and studied by genomic methods. These findings are changing the way microbiologists approach problems in aquatic and soil microbiology, and are providing better information about nutrient cycles and microbial diversity along the Oregon coast.

Scope of Impact – State, regional, national, and international

Source of Funding - Hatch, State, USDA, Sea Grant

Key Themes: Endangered Species

ISSUE OR PROBLEM

Our planet's large whale species are still endangered despite the current moratorium on whaling. Anthropogenic issues such as ship strikes, fishing entanglement and pollution continue to threaten their recovery. It is vital to protect the habitats most important to their recovery, yet for many species, these critical habitats are not known. The purpose of this project is to

determine and characterize the critical habitats of endangered whales in order to enable wise management decisions and assist in the survival and recovery of depleted populations.

IMPACT

In 2005, Bruce Mate of the Coastal Oregon Marine Experiment Station (ORE00914) received and analyzed a significant amount of data from the 2004 research seasons (Chilean blue whales, Gulf of Mexico sperm whales, and blue, fin and humpback whales from the central California coast). In addition, they tagged gray whales in Scammons Lagoon, Baja California Sur, Mexico, and tracked them to their feeding grounds in the Bering Sea and off the Aleutian Chain. They also tagged sperm whales, and collaborated with French researcher Christophe Guinet to conduct a second study of fin whales in the Mediterranean Sea.

We are now learning that individual whale populations may have critical habitats specific to themselves (such as the eastern gray whales, which is the only whale population to utilize the Baja California lagoons for breeding), as well as habitats that are shared by several populations (such as the Channel Islands, home to a food resource that attracts multiple species of baleen whales). Defining these habitats and the species which use them is a long-term goal of this and several other research programs. Our ability to learn where whales go translates into a better ability to assist their survival, by sharing data with governments and regulatory agencies with the power to protect the habitats and thence, the whales. Ensuring such survival requires understanding which areas of the oceans and continental shelves are most important to these animals.

Scope of Impact – State, regional, national, and international

Source of Funding - Hatch, State, Sea Grant, other federal dollars, private funds

Key Themes: Integrated Pest Management

ISSUE OR PROBLEM

Inefficient use of pesticides to control insect pests and plant diseases in agricultural crops is costly to producers and potentially harmful to the environment. Growers constantly strive to avoid these problems through careful management of pesticide applications. Plant scientists are combining the capabilities of the Internet and GIS-based technologies to provide site-specific weather data growers need to improve the accuracy of pest management decision-making and pesticide applications.

IMPACT

A world wide web site is being developed that uses both public and grower-supported weather stations plus GIS mapping capabilities to produce interactive, online pest risk maps that allow better estimates of pest and disease risk in crops and orchards. This approach will reduce the cost of obtaining site-specific weather data. In addition the project will allow—in areas having a small network of weather stations—the ability to estimate weather at all locations so that even those areas with unusual climates can be served. This system has potential for expansion and application to virtually all crops and growing regions. It is initially being developed for pear scab, fireblight, and codling moth pests in the Hood River and Medford Oregon tree fruit growing regions.

A survey conducted recently in the Hood River region by Leonard Coop of the Botany and Plant Pathology department (ORE00241) revealed that growers and pest control advisors (PCAs) are using the website supported by this project in increasing numbers. The survey also found that many, although not all, growers continue to rely on advice from experts like PCAs rather than use the online tools themselves. All (100%) of the survey respondents who were PCAs reported that the website provided "more informed pest management recommendations", "more effective pest control", and "improved timing of applications". Similarly, 85% of these respondents reported "reduced pesticide use" and 76% reported at least somewhat better yields resulting from their use of information offered through the website.

ISSUE OR PROBLEM

Managing pests in a cost-effective and environmentally friendly manner is an important component of a profitable and sustainable tree fruit industry in Oregon. The goal of this research is to develop and implement an integrated pest management program in tree fruit, which minimizes the use of disruptive, broad-spectrum pesticides and maximizes the benefits of naturally occurring biological control agents through the use of selective pest management techniques.

Impact

Adoption of IPM technologies in southern Oregon orchards, when done correctly, has been shown to result in reduced pesticide use while maintaining high standards of fruit quality. Approximately 40% of the local tree fruit acreage (3,000 acres) is currently utilizing mating disruption based IPM programs with minimal use of problem insecticides (e.g. organophosphates, carbamates, pyrethroids), with at least one-third of the acreage using no more than one organophosphate or carbamate application in 2005. An additional 50% of the tree fruit acreage (3,600 acres) employs monitoring of pest populations and use of weather data and phenology models to predict pest development, together these data are used to reduce the number of unnecessary pesticide applications. Access to these weather data and phenology models has been facilitated by the Pest Alert web page, which has had over 20,000 hits. During 2005, over 50 acres of orchards were in the process of transitioning to or have become certified for organic fruit production, utilizing organically approved pest management tactics such as mating disruption, codling moth granulosis virus and kaolin particle films, which were first tested locally at the Southern Oregon Research and Extension Center. Growers representing two-thirds of the tree fruit acreage attended the biweekly pest management forums and discussed monitoring methods and results, and used this information to modify and improve their pest management programs.

ISSUE OR PROBLEM

IPM strategies in vegetable production systems in Oregon include cover crops and raw and composted manure for management of snap bean and sweet corn root rots and snap bean white mold; and monitoring, sanitation, novel chemistries, and region-wide spatial management for control of cabbage root fly.

IMPACT

This project by Alexandra Stone (in collaboration with Powelson, Ludy, and Ocamb) of Horticulture (ORE00329) has demonstrated the significant negative relationship between root rot severity and yield of Jubilee and other corn cultivars in Valley-wide field surveys over 4 years.

The information has bolstered industry confidence that root rot was the primary cause of corn productivity decline and that the introduction of root rot tolerant and high-yielding varieties are a major step towards improving the profitability of sweet corn production in western Oregon. Of the many management practices that have been investigated, rotation is the most reliable control measure for growers who can practice it. While we have not yet surveyed growers about how they may have changed their practices as they relate to root rot management, some growers have reported that they are adopting longer rotations. Changing rotational practices and realizing the impact of that change could take a farmer 5 or more years, so the impact of our findings will not be known immediately. It is likely that over time more grass seed growers will grow sweet corn as a rotation crop. Sweet corn (33,200 A; \$28.2 million per annum) is the keystone crop of the processed vegetable industry. This project has contributed significantly to the understanding and management of root rot, a problem which nearly destroyed this industry.

Scope of Impact – State, regional, and national

Source of Funding - Hatch, State, Agricultural Research Foundation, USDA, commodity funds

Key Themes: Nutrient Management

ISSUE OR PROBLEM

The sustainability of Oregon's agricultural production systems depends on the ability of growers to increase production efficiency and meet crop quality standards while protecting soil and water resources. Field and laboratory research will be conducted to develop tools and practices that farmers can use in managing fertilizers applied to cereal grains and specialty crops.

IMPACT

Calibration of the Nmin soil test for direct-seed winter wheat increased the profitability of winter wheat as a rotation crop in the southern Willamette Valley. Experimental results by Neil Christensen (ORE00245A) in Crop and Soil Science show that growers can reduce Nitrogen (N) fertilizer rates (cost) by 50 lb N/a (\$15 /a) while avoiding under- or over-fertilization with N. Using the Nmin soil test and direct-seeding of winter wheat can reduce N input costs, reduce fuel costs, and shorten crop rotations while reducing surface runoff that causes erosion and deterioration of water quality. Retail fertilizer prices have increased since 2001. Nitrogen cost is almost 25% more, phosphorus 15%, and potassium 55%. Fertilizer application for maximum economic return was the focus of effort in 2005 by continuing research with the N mineralization test in grass seed production with field trials in 17 grower fields and by publishing two grower guides for fertilizer use in grass seed production. The guides are based on more than a decade of research in western Oregon. Following recommendations in the newly published fertilizer guides will save growers money. For example, more than 300,000 acres of perennial grass seed is produced in western Oregon. Decades of annual phosphorous fertilizer application above crop need raised available soil phosphorus to a level that precludes fertilizer P need. If P2O5 application was reduced by 20 lb/a on half the western Oregon grass seed acreage, growers would save \$750,000 annually.

Scope of Impact – State, regional, and national

Source of Funding - Hatch, State, Agricultural Research Foundation, USDA, National Research Initiative, National Science Foundation, Oregon Department of Energy

Key Themes: Water Quality

ISSUE OR PROBLEM

There was significant public concern over high prevalence of skeletal deformities in one section of the Willamette River (Newberg Pool) compared to upstream sites. This project aimed at identification of potential environmental stresses that contribute to skeletal deformities in fish.

IMPACT

Work published in 2004 by Larry Curtis of Environmental and Molecular Toxicology (ORE00706) and OSU colleagues demonstrated a strong association between parasitic infection and skeletal deformities in Willamette River fish. These results were of special interest since: (1) Willamette River water was increasingly considered as a drinking water source for communities in the southwest Portland metropolitan area; and (2) there was a consistently elevated prevalence of fish skeletal deformities in Newberg Pool, the site for the intake of the water treatment plant designed for serving that area. The association of parasites and skeletal deformities only suggested chemical contamination was not of special concern in Newberg Pool. Controversy over suitability of Willamette River water in communities southwest of the Portland Metropolitan area persist. Current population sizes exceed capacity of water wells for long term supplies. The city of Sherwood recently approved potential use of water from Newberg Pool by public vote. The research from this project was a major source of information for the local government and the public. The cost of purchasing water from the Willamette River treated at Wilsonville was about one-half that of contracting with the City of Portland for water from their reservoir (\$31 million vs. \$60 million). Sherwood is only of several cities in the southwest Portland metropolitan area that will face water shortages in the near future. The results of this research are of continuing interest to policy makers.

ISSUE OR PROBLEM

Wildland watershed issues in Oregon, across the West, and in fact, globally are of increasing interest as population pressures increase and the twin issues of "feeding a hungry world" and "maintaining a quality environment" vie for attention. Livestock and agricultural practices are often seen by the public and some governmental agencies as potential water quality hazards. The purpose of this research is to evaluate the relationships between land uses and water quality with an eye toward finding workable compatibilities and fostering them.

IMPACT

In this series of Oregon Watershed experiments, the Principal Investigator, John Buckhouse and his graduate students and colleagues (ORE00276) in Rangeland Ecology are attempting to understand the bio/physical relationships which are pivotal in management schemes which will allow both to happen. Vegetation management, be it control of invasive species, reestablishment of native riparian woodies, or non-traditional successional seres as a stepping stone toward reestablishment of native plant communities is crucial in understanding watershed management. The role of management in establishing positive, functional watersheds which provide an economic viability, an ecological stability, and an aesthetic sensibility is

rational and appropriate in developing quality environments while at the same time providing the ability to sustain an ever increasing human population.

It continues to appear that proper livestock grazing can mimic ungrazed controls in terms of streambank stability; under a well managed rotational grazing program, streambank erosion is statistically similar to ungrazed controls. Crested wheatgrass, a non-native plant, has a role in providing successional success in rehabilitation of depauperate rangelands. The crested wheatgrass is tied to soil conditions (heavier clays) and mycorrhizal presence. The crested wheatgrass will maintain the site, providing increased organics and maintain grass dependent mycorrhizal communities, enabling native perennial grasses to recolonize within 25 years.

Scope of Impact – State, regional, and national

Source of Funding - Hatch, State, other federal grants, local government agencies, private corporations

NATIONAL GOAL #5: Enhanced economic opportunity and quality of life for Americans. Empower people and communities, through research-based information and education, to address economic and social challenges facing our youth, families, and communities. We selected 3 projects from 3 key themes to highlight in this year's report.

TOTAL EXPENDITURES: \$921,691

Hatch: \$43,828

Multistate: \$72,698

State: \$592,936

Other: \$212,229

(other includes funds from sources such as grants, foundations, etc.)

TOTAL FTE FROM ALL SOURCES: 5.6

KEY THEMES

Key Themes: Consumer Management

ISSUE OR PROBLEM

Marketers need to know what actions that are aimed at individuals (consumers or business customers) will trigger a desired behavior. Applied marketing research by the North Willamette Research and Extension Center (NWREC) will systematically and objectively identify, collect, analyze, and disseminate information for the purpose of assisting management in decision making related to the identification and solution of problems and opportunities in agribusiness marketing.

IMPACT

Based on the research findings by Ulrich Orth at NWREC (ORE00511), businesses in the fruit juice and wine industry are adjusting their approach to product and brand design. More attention is being paid to ascertain that brand message and product experience are consistent, with positive impact on consumer satisfaction and repeat sales. For their new product launch, the beverage producer selected the organic packaging design in order to increase market share and profitability. Oregon food and beverage manufacturers have also started changing their mind set and considering the importance of packaging as a premier tool for targeting market segments and elevating their products above competitors' offers. Follow-up research will expand the initial knowledge base to other types of businesses and will examine options for effectively utilizing the family business characteristic.

Scope of Impact – State, regional, and national

Source of Funding - Hatch, State, commodity groups

B. STAKEHOLDER INPUT PROCESS

Actions Taken to Seek Stakeholder Input and Encourage Their Participation

At Oregon State University, College of Agricultural Sciences (CAS), there are several formal avenues for soliciting stakeholder contributions. These meet fairly regularly to aid in the direction and guidance of our programs. These include:

1. Dean's Advisory Council – this small advisory council is composed of industry, consumer, and environmental representatives
2. Advisory Councils of each department and branch station – these include membership drawn from the discipline or relevant region
3. Advisory Councils of each county extension office – these are more broadly based and relate to extension program areas in a county or region. Agriculture is one of the Extension program areas in Oregon.

In 2004, CAS leaders also met with a number of Oregonians who work in natural resource industries and organizations for two half days of discussions in mid June, 2004. CAS administrators posed questions and listened to what attendees had to say, then compiled these stakeholders' comments, observations, and suggestions. The summary was posted on the CAS website and points were incorporated into the new CAS Strategic Plan.

The meeting's objectives were to:

- a. conduct a forum with the College of Agricultural Sciences and its stakeholders to share and discuss the College's draft Strategic Plan, budget information, proposed Policy Option Packages, and other University issues related to the College
- b. seek stakeholders' views, opinions, insights, and recommendations relating to the College's overall direction and priorities for the future

OSU/CAS has and continues to solicit and receive thoughtful critiques and sometimes views that differ from its own. Responses are prepared in a timely fashion.

Research, extension and education faculty within the College of Agricultural Sciences (CAS) represent a wide array of disciplines at Oregon State University (OSU). Their scope of impact reaches stakeholders at the local, state and national levels. In an effort to solicit input from these stakeholders, there are several levels of participation which directly result in opportunities for discussion necessary for continual advancement toward recommended program goals. A sampling of actions taken are provided as follows:

1. OSU/CAS also took part in the planning processes of other units at Oregon State University, including the OSU Extension Service.
2. The College's Agricultural and Resource Economics Department is assessing the effects of university-industry relationships on the type and quantity of agricultural biotechnology research in U.S. universities. Of particular interest is how these relationships affect the

excludability of biotechnology research, that is, the degree to which the research is immediately profitable, as opposed to being useful only in the public domain.

3. The Horticulture department organized a stakeholder meeting of the nursery industry and related organizations including Oregon Department of Agriculture, USDA, Oregon Association of Nurserymen, Chemeketa, Horticultural Research Institute and the Oregon Garden.
4. Crop & Soil Science faculty annually discuss departmental priorities with commodity commissions through informal commission meetings and formal special sessions held during grower association meetings. Several faculty work with metro-based businesses (biosolids, cereal breeding, grain dealers, and milling/baking companies).
5. The Coastal Oregon Marine Experiment Station rotates their Board meetings to different locations along the coast and advertises the meetings in local newspapers. A partnership with ShoreBank Enterprise Pacific has formed the Community Seafood Initiative. The mission of this partnership is to foster entrepreneurship, and to help small and mid-size enterprises in the seafood industry to develop products and enter new markets. Engaging stakeholders of various sectors will ensure successful delivery of the program goals. A web site called "Heads-Up" disseminates information about the program as well as giving timely research information.
6. Experiment Stations throughout the state hold "Field Days" for industry and community members to observe research in progress and to discuss new issues. Grower meetings are held to seek input on research needs. Advisory board meetings are held to discuss current research programs and future research direction and needs.
7. We also have active initiatives with the Confederated Tribes of the Warm Springs and the Confederated Tribes of the Umatilla. These include a broad array of programs in education and research. These and other tribes participate in undergraduate teaching in the college particularly in developing a multicultural understanding of natural resource management. OSU degree programs in Natural Resources and General Agriculture are available at Warm Springs. The university has a long standing memorandum of understanding and cooperation with the Confederated Tribes of the War Springs that has been mutually beneficial and includes extension, academic teaching and research.
8. The college operates education programs that focus on Hispanic populations of the region. Hispanics play a major role in the agriculture of the Pacific Northwest. Areas of emphasis have been in the nursery crop and tree fruit crop growing regions of the state.

Process Used for Identifying Stakeholders and Approach Used to Collect Input from These Groups: Oregon has approximately 30 statutorily appointed commodity commissions and grower organizations. Most of these have research committees, and the membership of these groups provide a rich source of engaged individuals from the natural resources community. Oregon has a wealth of active environmental, consumer, and community organizations including the Isaac Walton League, Oregon Environmental Council, the Nature Conservancy, Defenders of Wildlife, and Sierra Club, the Food Alliance, Oregon Tilth, and other organizations. The university has a minority Board of Visitors to advise the university and its component colleges on minority affairs. The college also has student governance through the Agricultural Executive Council. This is a very active student council with representatives from over 30 student organizations representing a broad base of students. These groups add breadth to more

traditional student groups expected in a college of agriculture. These organizations provide a broad perspective for input to the management of the College.

How Input Was Considered: Pertinent feedback is received from various stakeholders on a wide range of research and program initiatives which are currently in progress. As a result of the input received, OSU administrators and faculty modify work plans to improve the design of administrative and research projects and provide specific opportunities for continued feedback. Information is disseminated to communities through newsletters, local newspaper coverage, and radio programs. Administrators and faculty use input to prioritize resource allocations, inform other researchers and policy makers of trends and concerns. Recommendations from various advisory boards represent key constituent views, and are useful in the developing extension programs which reach the agroproduction sector.

C. PROGRAM REVIEW PROCESS

There have been no significant changes in our program review processes since our 5-Year Plan of Work was submitted.

D. EVALUATION OF THE SUCCESS OF MULTI AND JOINT ACTIVITIES

The OAES currently has 105 scientists who contribute to 70 multistate projects under the five National Goals. Each multistate project submits an annual report on the group's activities, accomplishments and plans for the future. The OAES makes no attempt to evaluate any of the multistate research activities as that is accomplished through the efforts of the scientists and administrative advisors in each of those programs. The Western Research Coordination and Implementation Committee (RCIC) is responsible for evaluating each new or revised proposal for projects, and the AES directors approve or disapprove of them based on recommendations from the RCIC.

- NATIONAL GOAL #1 (NC-1029, NC-1036, NC-1131, NC-1142, NCERA-180, NCERA-190, NCR-131, NE-1011, NE-1012, NE-1018, NE-1020, NE-1024, S-294, S-1004, S-1007, W-006, W-106, W-112, W-192, W-1004, W-1112, W-1128, W-1133, W-1147, W-1150, W-1168, W-1171, W-1177, W-1185, WERA-27, WERA-39, WERA-43, WERA-55, WERA-58, WERA-60, WERA-69, WERA-72, WERA-77, WERA-81, WERA-89, WERA-97, WERA-99, WERA-110)
- NATIONAL GOAL #2 (NE-1018, W-1122, W-1150)
- NATIONAL GOAL #3 (NC-1023, W-1002, W-1003, W-1005, WERA-2)
- NATIONAL GOAL #4 (NC-140, NC-218, NCERA-3, NCERA-59, NCR-193, NCERA-103, NCERA-125, NRSP-3, S-1014, W-1045, W-1128, W-1133, W-1170, W-1185, W-1188, W-1190, WCC-1003, WERA-40, WERA-43, WERA-58, WERA-60, WERA-77, WERA-81, WERA-89, WERA-97, WERA-99, WERA-102, WERA-103)
- NATIONAL GOAL #5 (NC-1011, NE-1012, W-192, W-1177, WERA-055, WERA-058, WERA-207, WERA-208, WERA-1001)

The OAES actively encourages our scientists to participate in multistate activities. We continue to monitor our progress.

E. INTEGRATED RESEARCH AND EXTENSION ACTIVITIES

Oregon State University has a unique organizational approach that integrates research and extension programs. All faculty in the statewide branch stations have an academic home in a campus department. They are full members of the department faculty and are fully enfranchised in the departments, colleges and university. As an example, extension faculty members stationed in a county unit hold an academic appointment in a department and fully participate in promotion and tenure activities of the department. They hold tenure track and professorial positions. They are fully represented in the Faculty Senate of the university. They plan and implement education (both academic and extension) and research programs in a fully integrated fashion. The following eight (8) projects are good examples of our efforts related to integrated research and extension activities.

Title: Sustaining Local Food Systems In A Globalizing Environment: Forces, Responses, Impacts (Larry Lev – ORE00685A)

Issue: The globalization of food supply presents significant economic, social, and environmental challenges to Oregon agriculture. As the agriculture and food system becomes more concentrated, it also becomes more vulnerable to disruptions and prone to accidents. This project works to increased knowledge and understanding about the forces that motivate and shape the formation of local food systems and affect food system sustainability.

What has been done: Interest and participation in direct and local marketing remains high and has been expanded to cover much of the state. Earlier events have spun off and now operate successfully on their own (e.g., in La Grande and Portland). The Oregon Board of Agriculture (ODA) requested an in-depth briefing on farm direct marketing and one result of that briefing was the decision by the ODA to become a financial sponsor of the annual direct marketing conference.

Three extraordinary participatory research events were conducted in 2005. In March, a rapid market assessment was conducted of the Hillsdale Winter farmers market. The participants were Oregon farmers and market managers who wished to learn market research techniques and observe a functioning winter market. In June a one-half day market research workshop was conducted as a pre-conference activity for the Agriculture and Human Values Conference. The 20 participants were academics from the US, Canada, Australia, and Italy who wanted to learn market research techniques and observe two Oregon markets. In September, 18 market managers and public sector officials from the U.S. and Canada attended a 2.5 day workshop to learn about market research techniques and visit seven Oregon markets. The net result of these activities was a quantum leap in the spread of these OSU developed research approaches. They are now being used throughout the U.S., Canada, and the U. K. On-going work through efforts funded by the

Western Risk Management Center include the development of a new enterprise screening tool and a value-added toolkit.

August 2005 marked the end of a major USDA/IFAFS grant that focused on direct and local marketing. New proposals were submitted during the year that seek funding for a professional development educational effort to better understand alternative marketing opportunities and a research project to document the emergence of an Agriculture of the Middle for producers who are not competitive in commodity markets and too big for direct markets. In terms of publications, the most significant accomplishments are a (1) detailed extension style manual that explains the costs and benefits of third party certification for agricultural producers, (2) contributed chapters on marketing and certification to the 2006 Farming Sourcebook (3) three rapid market assessment reports. A draft paper on changes in numbers of farmers markets in the state provides the first detailed assessment of numbers of individual markets that have opened and closed. All previous studies have examined net changes and therefore missed this part of the story.

Impact: By all available measures, direct and local food markets continue to boom in Oregon. The number of farmers markets grew from 38 in 1998 to 68 in 2005 while the number of both farmers and restaurants/retailers in the Ecotrust/ Chefs Collaborative guide doubled between 2002 and 2005. OSU has played a key role through outreach, research and training activities. The OSU Small Farms Program workshops and conferences have provided many producers with an entry-level training in direct marketing. Over the period 2000-2005 more than 130 individuals participated in at least one of the 18 rapid market assessment studies and received research methods training. As a direct results of these studies, individual markets have taken decisions to change (or not change) market frequency, length of season, hours, product mix, advertising outlets and a host of other difficult decisions. To cite one example, based on a 2004 OSU-led study, the Winchester U.K. market decide to double the number of markets in 2005 and achieved a doubling of market sales. Communities and statewide organizations have made policy decisions more favorable to direct marketing based on a better understanding of the benefits gained. OSU research results have been put to use in other ways. Just in the past two years, OSU research results have played a key role in successful grants proposal written by the Hillsdale Winter Farmers market and the Ecumenical Ministries of Oregon and in submitted proposals by the Corvallis/Albany Farmers Market Association and the statewide Oregon Farmers Market Association.

Title: Sustainable Soil, Water And Crop Management Strategies For Semiarid Oregon (Don Wysocki, Columbia Basin Agricultural Research Center, ORE00183A)

Issue: Soil and water conservation are very important in sustaining dryland farming in semiarid Oregon. Adopting direct seed farming and producing high end use quality wheats are important aspects that will keep farms in Oregon profitable. This project examines direct seed farming practices and nutrient management strategies. The purpose of this project is to test and develop conservation farming practices that protect soil health and water quality and improve wheat end use quality and maintain or enhance current wheat markets.

What has been done: Cropping systems research was conducted on nitrogen fertility of wheat, variety development of winter and spring canola, and yellow and brown mustard. Nitrogen rate and timing trials were conducted on hard red winter wheat, hard red spring wheat, hard white spring wheat, and soft white spring wheat at Pendleton, Oregon. Trials were sown in the fall of 2004 and 2005 resulting in 80 experimental units each season. Results of these trials collectively show that among fertilizer treatments and varieties optimum nitrogen fertilizer varied significantly with landscape position, soil depth and available water. Canola trials consisted of 24 lines of winter canola sown and Pendleton and Hermiston, Oregon. Trials at Hermiston are irrigated, while trials at Pendleton are rainfed only. Up to 4000 lb/seed per acre were obtained at Hermiston and 2700 lb/seed per acre at Pendleton. Spring yellow and brown mustard and canola were direct seeded into various residue management treatments. Yields were 500-700 lb/acre. Residue was left standing, burned, harrowed, or flail mowed. Canola was more sensitive to residue than either brown or yellow mustard. Brown mustard performed the best of the three crops

Impact: Direct seeding of winter and spring cereals varies between 10 and 80 percent of cropland acres in counties in eastern Oregon and Washington. Information from direct seeded wheat and nitrogen management is helping growers refine fertility rates and apply the appropriate amount of nitrogen, phosphorus and sulfur. Canola research has enable growers to direct seed into chemical fallow and produce acceptable stands and consistent yields. Growers have pooled funds and sought grant money to form an LLC to market value added products from canola. The LLC has received \$12,000 in grants monies. A local farmer owned cooperative has purchased crushing equipment and will have crush facilities on-line by January 2006

Title: Integrated Pest Management (IPM) Of Arthropods Of Pear In Southern Oregon (Phil VanBuskirk, Southern Oregon Research and Extension Center, ORE00274)

Issue: Managing pests in a cost-effective and environmentally friendly manner is an important component of a profitable and sustainable tree fruit industry in Oregon. The goal of this research is to develop and implement an integrated pest management program in tree fruit, which minimizes the use of disruptive, broad-spectrum pesticides and maximizes the benefits of naturally occurring biological control agents through the use of selective pest management techniques. The project will also look at the impact that ground covers may have on pests and beneficial species. In chemically constrained systems, emphasis will be given to pesticide resistance management, and evaluation of new pesticides for efficacy and impacts on beneficials.

Progress: The integrated pest management program conducted cooperative research as part of the IFAFS and RAMP grants led by Washington State University and the University of California, respectively. A number of on-farm demonstrations were conducted in 2005. Adoption of mating disruption, a selective and relatively non-toxic control tactic, for control of codling moth, the key pest in pome fruit production in the Pacific Northwest, is a primary goal of this project. In one orchard, three types of mating disruption were compared: the standard hand applied pheromone dispensers; a novel pheromone delivery product, Ecotape; and ultra low volume applications of microencapsulated pheromone sprayed with a modified applicator mounted on an ATV and applied in a spray volume of 1.5 gallons per acre. Additionally, in

seven other orchard blocks the ultra low volume method was compared to the conventional hand applied dispensers. All the methods of mating disruption provided equivalent levels of control of codling moth with fruit samples at harvest indicating that 99.95% of the fruit was free of any codling moth injury.

Codling moth granulosus virus, another highly specific and relatively non-toxic control for codling moth, was tested both at the Research Center orchard and in grower orchards. The results with this biological control method continue to look very promising. A study funded jointly by the Oregon Bartlett Pear Commission and the Washington Tree Fruit Research Commission examined the use of the granulosus virus in conjunction with mating disruption for control of codling moth for the second year, results consistently indicate that in areas of high codling moth pressure the addition of mating disruption may not be cost effective versus a program featuring more intensive use of the granulosus virus.

Studies on trapping codling moth using a kairomone (pear ester) which attracts both male and female moths demonstrated that this new technology can be used effectively in pears, and may be used to time sprays with greater precision so that materials such as the granulosus virus, which are limited by their lack of residual activity, can be applied when egg-laying by females is at peak levels. Numerous trials were conducted at the Research Center orchard in conjunction with agricultural chemical companies to evaluate new materials. One research project, now in the completion phase, assessed the effect of a number of novel chemical controls on the European earwig, which can act as a beneficial insect in pome fruit. Information from this research will be combined with results on other natural enemies from collaborating researchers to devise a matrix informing growers of the potential negative impacts that these newer pesticides can have on naturally occurring biological control agents. This risk-rating system can then be used in developing IPM programs which encourage the conservation of natural enemies.

Meetings with local growers were conducted on a biweekly basis throughout the growing season to discuss pest management options. The Pest Alert web page developed in 2002 continues to be improved and updated with new pest prediction tools.

Impact: Adoption of IPM technologies in southern Oregon orchards, when done correctly, has been shown to result in reduced pesticide use while maintaining high standards of fruit quality. Approximately 40% of the local tree fruit acreage (3,000 acres) is currently utilizing mating disruption based IPM programs with minimal use of problem insecticides (e.g. organophosphates, carbamates, pyrethroids), with at least one-third of the acreage using no more than one organophosphate or carbamate application in 2005. An additional 50% of the tree fruit acreage (3,600 acres) employs monitoring of pest populations and use of weather data and phenology models to predict pest development, together these data are used to reduce the number of unnecessary pesticide applications. Access to these weather data and phenology models has been facilitated by the Pest Alert web page, which has had over 20,000 hits. During 2005, over 50 acres of orchards are in the process of transitioning to or have become certified for organic fruit production, utilizing organically approved pest management tactics such as mating disruption, codling moth granulosus virus and kaolin particle films, which were first tested locally at the Research Center. Growers representing two-thirds of the tree fruit acreage attended the biweekly pest management forums and discussed monitoring methods and results, and used this information to modify and improve their pest management programs.

Title: Improving Microbial Safety Of Northwest Fresh And Processed Berries (Yanyun Zhao, Food Science and Technology, ORE00708)

Issue: Fresh Northwest berries and their juices and purees have challenged the belief that high acid foods cannot harbor viable pathogenic bacteria. They could also act as a vector for foodborne illness. This project is to enhance and ensure the safety of Northwest fresh and processed berries through integrated research, education and Extension efforts.

What has been done: Research results on the microbial safety of berries have been shared with berry commissions, discussed in various regional and berry related conference and meetings, and published in the peer-reviewed journals. This no doubt has both short-term and long-term impacts to the berry industry.

Impact: The integrated efforts in Research, Education and Extension for improving microbial safety of berries has significantly increased the awareness and knowledge of berry growers, processors, and educators about the microbial safety concerns and their controls in berry fruit production and processing. Over 50% of workshop participants indicated that they will take additional steps to ensure the microbial safety of their products. Of 117 students who took the "Food Safety and Sanitation" class, 44 students took the National Food Safety Managers Examination and received the national "Food Safety Manager Certification." These students are the future processors, regulators, educators, and/or inspectors, thus having both short-term and long-term impacts for the berry industry. Also, workshop participants reported that the training enhanced their understanding on the importance of SSOPs and HACCPs, and improved their knowledge in developing HACCP plans.

Research efforts in developing strategies to control microbial growth on the surface of fresh berries have continued. In addition of studying the use of anti-fungi edible coatings to eliminate the growth of molds, the use of electrolyzed oxidizing water (EOW) and ozonated water (OW) as surface disinfectant was evaluated.

Title: Value-Added Processing For Fish And Fishery By-Products (Jae Park, Coastal Oregon Marine Experiment Station, ORE00498A)

Issue: Conventional protein recovery system yields 20-25%, resulting in a significant amount of unused proteinous materials. Surimi processing also leaves 33,000 mt of refiner discharge in the U.S. each year. Dark muscle fish such as sardine has not been utilized as human food yet. This project investigates a new protein recovery system, using pH shift, for the recovery of functional proteins from Pacific whiting and sardine. In addition, consumer-friendly gelatin from surimi by-products will be developed. The overall objective is to investigate various ways for maximum utilization of fish and fishery by-products through protein recovery using pH shift and upgrading feed/waste to food.

What has been done: Biochemical characteristics of Pacific whiting muscle proteins extracted at acidic, neutral, and alkaline conditions were investigated as affected by various ionic strength

levels. Protein solubility at pH 4 declined, as NaCl was added up to 200 mM, due to protein aggregation through hydrophobic interactions. In contrast, at pH 7 and 10, solubility increased as NaCl was added up to 400 mM after which it remained constant. Changes in total SH content and So were highly related to the different molecular weight distributions of the soluble proteins. Physicochemical characteristics of sarcoplasmic proteins (SP) from rockfish and their interaction with Alaska pollock surimi (myofibrillar proteins) were investigated. Solubility of SP was significantly suppressed at acidic pH (2-4) and in the presence of high salt concentration (0.5 M NaCl). Addition of SP appeared to delay thermal denaturation of myosin and actin. The least amount of proteins was lost when SP were treated at pH 2 or 3 followed by precipitation at pH 5.5. Gelation properties of SP were inferior to myofibrillar proteins, but positively contributed to gelation with myofibrillar proteins as judged by breaking force.

Impact: Studies of protein solubility at various pH confirmed that the maximum level of proteins can be extracted and recovered if the proper pH condition is provided, which contributes to improved yield and increased profits. Gelation properties of SP were inferior to myofibrillar proteins, but positively contributed to gelation with myofibrillar proteins as judged by breaking force. SP proteins could therefore be beneficial in gelled products by improving yield of Pacific whiting harvests for human use and reducing protein lost in waste water streams.

Title: Bridging The Divide - Collaborative Integration Of Research And Community Development (Michael Morrissey and Gil Sylvia, Coastal Oregon Marine Experiment Station, ORE00945)

Issue: There is a need to maximize the economic impact of existing and future research on rural and distressed coastal communities in Oregon and Washington and elsewhere. It is important as well to involve communities in rebuilding their economy and protecting their natural. This project will use a coordinated network of institutions and industry groups that combines research, education, and community and economic development in a community-based delivery model to support rural communities. The collaborators include the OSU Seafood Laboratory and Coastal Oregon Marine Experiment Station, the Duncan Law Seafood Consumer Center (a non-profit regional facility providing links between the seafood industry and the consumer, and promoting the consumption of seafood through education, training, research and dissemination of information) and Shorebank Enterprise Pacific (a non-profit conservation-based loan fund that services the Oregon and Washington coast, specializing in providing capital and business services to promising ventures which add value, provide quality employment opportunities, and offering long term economic and environmental integrity to rural coastal communities).

What has been done: One of the most significant results in this project was the formation of the partnership between Oregon State University and ShoreBank Enterprise Pacific, a community development financial institution. This partnership which began with the OSU Seafood Laboratory, the Coastal Oregon Marine Experiment Station and ShoreBank has expanded to include other institutions such as the Seafood Consumer Center and Oregon Sea Grant and is now called the Community Seafood Initiative (CSI). CSI has been able to continue after the initial USDA funds were expended by obtaining additional support from federal grants, foundations and private capital.

The mission of the partnership is to strengthen food systems in rural communities by supporting key catalysts for change. CSI does this by encouraging small businesses to cooperate in new ways around common goals; and creating pathways for harvesters and processors to easily access traditionally disparate resources--research knowledge, product and market assistance, and business and capital assistance. Partnerships like CSI are vital for economic development, especially when most rural communities have minimal to no institutional resources available for small food producing businesses to assist them through the process of change. The outcomes for the CSI are categorized by 1) RESEARCH AND TECHNOLOGY and 2) EXTENSION AND EDUCATION.

RESEARCH AND TECHNOLOGY: CSI has implemented a systematic product development process (Stage-Gate) to assist small and mid-size businesses in developing new value-added products. Some of these products include a salmon-jerky, frozen shellfish products and fish products focused toward the Hispanic marketplace. Small-boat albacore fishermen have also benefited by using time/temperature effects on quality to improve their onboard handling techniques and expand into new markets and receive a higher ex-vessel price. The Dungeness crab fishery is pursuing Marine Stewardship Council certification with CSI assistance which signifies sustainability of their fishery and opens additional markets. The nutritional value found through research on West Coast fish, primarily albacore, on omega-3 fatty acids and low mercury levels, is being quoted in marketing and sales materials of many fishermen and small coastal processors and has helped to expand their markets. There has also been an increase in the number of local businesses using new technologies such as high pressure processing, flexible packaging and ultra-fast freezing which is generating new opportunities for value-added products.

EXTENSION AND OUTREACH: CSI continues to hold beneficial industry training workshops on value-added products and new market opportunities. These workshops include presentations on the realities of accessing new markets, how to develop new products, research opportunities that can improve business practices, and where to go to get the resources. Several attendees have followed up for direct one-on-one assistance or assistance for an entire association, like the Pacific Shellfish Growers. We also have educated over 500 end-consumers a year on the benefits of consuming and purchasing value-added seafood that is harvested and processed locally.

Impact: CSI has exceeded its investment goals for coastal seafood businesses by investing more than \$1 million and providing product development assistance to over 15 businesses which resulted in six new products launched into the marketplace. CSI has also provided planning and development assistance to over 40 businesses. In addition to our proposed outcomes, CSI has raised the profile and value of scientists, institutions and organizations that support food system change. The activities include 1) presenting our work at key seafood conferences and to key state officials; 2) creating a product development system and resource pool to help entrepreneurs successfully develop value-added products; 3) applied research projects requested by small and mid-size businesses that helps sustain the resource and strengthen their position in the marketplace. CSI has helped increased and/or preserve the number of economically successful locally owned food related enterprises. The financial investments and technical assistance of CSI has retained 205 jobs and created 35 new jobs for seafood harvesting and fishing companies. CSI has leveraged financial resources and strategically grew the number of active partners. Every

year CSI has raised an additional \$150,000 or more from other funding sources to support our activities. CSI has also attracted new food market experts and public partners to assist in our activities.

Title: Ecological Analysis Of Rural Land Use Practices (Pat Kennedy, Eastern Oregon Agricultural Research Center, ORE00147)

Issue: There is data to suggest the decline in agroecosystem biodiversity is related to changing agricultural practices, and these changes have caused declines in a wide variety of plants and animals. For example, there is evidence that nesting populations of ferruginous hawks and Swainson's hawks are declining nationally and being replaced by red-tailed hawks (the white-tailed deer of the raptor world) as human disturbance increases in native rangelands. It is important to determine the landscape and land use factors that contributed to supporting earlier abundant raptor populations as well as to evaluate past and present trends in landscape change. Such information will allow the development of sustainable rural land use practices that include mitigation of direct lethal effects, e.g., reducing electrocution of raptors by rural powerlines, and enhanced habitat management, e.g., development of ecologically sustainable grazing practices. .

What has been done: This OAES project consists of four research and extension components: (1) We were awarded a four-year USDA National Research Initiative grant for \$450,000 to conduct and 'Experimental Analysis of Cattle Stocking Rates on Rangeland Biodiversity.' The research team has held Planning sessions, hired doctoral students, and established a project web page.

(2) The team completed the third field season in an examination of whether the Zumwalt Prairie still excellent hawk habitat and have applied for additional funding from USDA NRCS, Wildlife Habitat Management Institute to conduct a 4th and final field season in 2006. Also in 2005, the team was awarded a \$96,000 grant from The Nature Conservancy to hire post-doctoral research associate in landscape ecology to analyze the temporal changes in the land use patterns of this landscape relative to hawk habitat. Dr. Anne Bartuszevige started with EOARC January 1, 2005 and is scheduled to continue working until the end of 2006. As a result of her efforts and the efforts of our computer/GIS Specialist, Colette Coiner, we have georeferenced a digitized all of the historic aerial photos for this landscape (photos are available every decade since 1938). These are ready for landscape analyses to evaluate the landscape changes that have occurred in the hawk nesting territories.

(3) 'The Influence of Rural Powerlines on Rangeland Raptor Populations' is being conducted by a PhD student (Robert Lehman) who has submitted his first dissertation chapter for publication review. He has produced a draft of the second chapter and is expected to finish his dissertation (3-4 chapters) by the end of 2006.

(4) Initial efforts investigating the 'Effects of Livestock Management Alternatives on Riparian Biodiversity' were devoted to working with a private company to develop a fenceless method of livestock control in riparian areas. However, that collaborative relationship ended at the end of 2005 when the company did not making sufficient progress at developing a workable prototype. Instead, a collaborative relationship was established with Dr. Ken Diebel with the Oregon Department of Agriculture to evaluate the effectiveness of private land riparian restoration efforts at restoring wildlife habitat. A proposal to EPA Region 10 is pending.

Impact: The team expects to produce ecological information that can be used by scientists, managers, policy makers and local landowners to identify and develop natural resource management practices that both maintain biodiversity and are economically viable.

Title: Utilization Of Municipal And Industrial Byproducts In Agriculture (Dan Sullivan, Crop and Soil Science, ORE00162)

Issue: Byproducts from farms, industry, and cities have nutrient value for crop production, but careful management practices are needed to protect environmental quality. Projects with municipal biosolids, wood ash, paper processing sludge, food processing residuals, and composts are underway or anticipated. Understanding and managing nitrogen and phosphorus in byproduct-amended soils is identified as a key area of project focus across a variety of industrial and municipal byproducts. This project develops guidelines for appropriate utilization of byproducts to protect environmental quality and to provide economical alternatives to landfill disposal or incineration.

What has been done: As interest in food waste composting grows, so does the need for proven low-technology composting methods. Stability testing has been proposed as a compost quality assurance tool to verify that finished compost will not serve as a substrate for human pathogen regrowth. We conducted this study to: (i) to evaluate the efficacy of low-technology, outdoor composting methods in producing a compost with a low, stable decomposition rate, and (ii) to determine the reliability of simple, 4-h compost stability evaluation methods.

Composting was conducted outdoors in winter and spring in Eugene, Oregon without moisture addition. Mixed food waste was combined with screened dairy solids and ground yard trimmings. Sawdust was used to cover windrows for the first 27 d of composting. Compost windrow temperatures remained above 55 oC for 30+ d. Carbon dioxide evolved with several 4-h test methods was strongly correlated ($r^2 > 0.7$) with CO₂ evolved using a 48-h test. A limited-turn windrow (LTW) composting system produced compost with slightly greater stability than a passively aerated windrow (PAW) composting system. Food waste compost samples had a low CO₂ evolution rate after 71 to 99 d using either system. Compost CO₂ evolution rate at 25 oC decreased with composting time, reaching approximately 1 to 4 mg CO₂-C g compost C⁻¹ d⁻¹ for the PAW method and 0.5 to 2 mg CO₂-C g compost C⁻¹ d⁻¹ for the LTW method. Putrescible organic matter in food waste was effectively decomposed by low technology composting methods. Several 4-h stability tests showed promise for implementation as quality assurance tools.

Impact: Improved compost testing procedures provide better management of the composting process, thereby improving product quality and reducing composting costs. Effective, reliable, composting methods for putrescible materials like food waste assist solid waste managers in reaching recycling goals, provide valuable soil amendments for soil improvement, and provide business opportunities for local entrepreneurs.