

Plan of Work Report

University of Idaho

College of Agricultural and Life Sciences

Idaho Agricultural Experiment Station

**Federal Fiscal Year
2001**

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Plan of Work for the College of Agriculture and Life Sciences, Idaho Agricultural Experiment Station (IAES), University of Idaho

Introduction

This Plan of Work report describes the research programs and impacts of the College of Agriculture and Life Sciences and the Idaho Agricultural Experiment Station (IAES) for fiscal year 2001, as required by the Agricultural Research, Extension, and Education Reform Act of 1998 (AREERA).

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Background Information

University of Idaho

The University of Idaho was created in 1889 by the territorial legislature with a major objective to offer all people higher education in the arts, letters and sciences. Total enrollment during the 01-02 academic year was 12,067 including 2,986 graduate students, and 303 law students. The University serves as the main center for research, professional education and research-based graduate programs and has the primary responsibility for granting the Doctor of Philosophy degree in the state of Idaho. In order to carry out its statewide mission, the University maintains instructional centers in Coeur d'Alene, Boise and Idaho Falls. Off-campus instruction is also presented at extension offices in 42 of 44 counties, 8 research and extension centers and 4 field stations.

The University of Idaho is a Doctoral/Research University-Extensive, the most comprehensive Carnegie Foundation rankings among Ph.D. granting research universities. The National Science Foundation (NSF) reports that UI historically receives 80-85% of all federal agency science and engineering research funds awarded to Idaho universities and colleges. In its latest available ranking, NSF reports UI on the top 25% (119 of 547) of U.S. universities and colleges in total research and development expenditures from all sources. There has been a 68% increase in total research funding from all sources since 1991.

College of Agricultural and Life Sciences

In addition to traditional campus instruction, the College of Agricultural and Life Sciences at the University of Idaho serves communities across the state with agricultural and family and consumer science research, and extension or “outreach.” The fall 2001 enrollment totaled 1,039, which is an all-time high for the College. The FY00 budget, including all revenue sources, was \$47.7 million. The college maintains ten agriculture research centers across the state to meet unique regional research needs. Almost half of the 240 college faculty members and 330 staff are located off of the Moscow campus at research centers and extension offices.

Idaho Agricultural Experiment Station (IAES)

The Idaho Agricultural Experiment Station (IAES) was created in 1892 with a federal allocation due to the Morrill Act (1862), which established the U.S. land-grant educational system and the Hatch Act (1897). The College of Agricultural and Life Sciences has always been a major contributor to research efforts at the University of Idaho due the basic philosophy that founded the land-grant educational system and the fact that agriculture has always been a major segment of the Idaho economy. The IAES and College of Agricultural and Life Sciences have a long tradition of supporting Idaho and Pacific Northwest agriculture, rural communities and families, and food processing industries with information derived from its agricultural research programs

IAES Program Impacts FY01

Goal 1: An Agricultural Production System that is Highly Competitive in the Global Economy

IAES Program 1: Plant Germplasm, Genetic Resources and Conservation, Plant Health and Well being (RPAs 201, 202, 203, 204, 205, 206, 211, 212, 213, and 214)

Performance Goals:

Identify and manipulate plant germplasm to improve crop plant performance and the production of seed and other plant products. Develop economical, biological and socially compatible crop management strategies that increase production efficiency.

Progress/Impacts:

Project Number: IDA01099

CRIS Number: 0171689

Goal: 1

Program: 1

RPA: 204

POTATO PRODUCTION AND STORAGE MANAGEMENT

Investigators: Kleinkopf, G. E.

Termination Date: 06/30/2001 Reporting period: 07/01/1996 to 06/30/2001

Termination Report:

Product testing in the potato storage research facility resulted in several products being registered for use in the potato industry. Sprout inhibitors, including peppermint, spearmint oils, dimethylnaphthalene and diisopropylnaphthalene were shown to be effective sprout inhibitors when applied as thermal aerosols or as volatiles in the headspace. Materials for disinfecting potato storages were evaluated and selected for their efficacy in controlling tuber decay. Chlorine dioxide was shown to be ineffective when applied according to labeled rates. Other disinfectants were only partially effective because of limitations in applying aqueous materials to potatoes in storage. Mixtures of hydrogen peroxide and peroxyacetic acid, although effective in laboratory tests, are difficult to move through the pile and better application methods must be developed before these products can be more effective. New potato cultivars, from the Federal/State breeding program at Aberdeen, Idaho, are tested for best storage management for proposed end uses. Several new release cultivars were evaluated and best management practices developed for use by the industry. Ranger Russet, Gem Russet, Umatilla Russet, Russet Burbank, and Legend Russet have been through three years of testing at three storage temperatures and with and without sprout inhibition (CIPC). This program is continuing to provide new and numbered lines with important storage data for industry uses. Potato production of new cultivars are evaluated at Kimberly Research and Extension Center for best management of field production. This program has demonstrated characteristics for each variety that will be adopted by industry growers. These characteristics include nitrogen fertilizer requirements, irrigation practices, herbicide sensitivity evaluations, disease ratings and comparisons and yield factors for production in southcentral Idaho.

Impact:

Storage management research is limited to very few facilities in North America. Research completed here has provided critical information on potato storage physiology and technology that has benefited all aspects of the industry including other academic units, potato growers, packers, processors and affiliated industries.

Project Number: IDA01109**CRIS Number:** 0172282**Goal:** 1**Program:** 1**RPA:** 212**ECOLOGICAL ASPECTS OF SOIL MICROBIOLOGY IN PEST MANAGEMENT & ENVIRONMENTAL PROTECTION TECHNOLOGIES****Investigators:** Knudsen, G. R.**Termination Date:** 06/30/2001**Reporting period:** 07/01/1996 to 06/30/2001**Termination Report:**

Laboratory and field experiments were conducted to develop methods to deploy and track microbial agents for plant disease control, and to evaluate their efficacy in the field. Transformation of *Trichoderma harzianum* with the gene for green fluorescent protein production helped to efficiently monitor the spread and persistence of the agent. Interactions of a fungal biocontrol agent with soil nematodes provided insight into one possible constraint on biocontrol in the field. Field experiments were conducted to evaluate combinations of brassica tissues and a biological control agent (*Trichoderma harzianum*) for control of *Fusarium oxysporum* in conifer seedling nurseries. Field trials were conducted at Forest Service nurseries at Coeur d'Alene, ID (Douglas-fir seedlings) and Lucky Peak, ID (Ponderosa pine seedlings). Disease will continue to be evaluated periodically over a several-year period.

Impact:

These results will be useful in optimizing the use of biological plant disease control agents for effective disease control. If combinations of biocontrol agents and brassica residues provide effective disease control, it will be a useful alternative to methyl bromide fumigation.

Project Number: IDA01117

CRIS Number: 0173331

Multi-State Project: W-6

Goal: 1

Program: 1

RPA: 211

PLANT GENETIC RESOURCE CONSERVATION AND UTILIZATION

Investigators: Zemetra, R. S.

Termination Date: 09/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Utilization of the germplasm system in Idaho in 2001 showed a decrease in the number of individuals requesting accessions, an increase in number of species requested, and a decrease in total number of accessions requested compared to 2000. A total of 966 accessions covering 171 species were requested by 21 individuals. Of the 21 individuals, 9 were related to public research programs and 12 were private individuals or related to private research programs. At the University of Idaho, primary germplasm utilization was by the wheat breeding programs using wheat accessions in the evaluation and improvement of wheat cultivars for the Pacific Northwest. Research on the potential for gene flow between wheat and jointed goatgrass by GISH analysis was done using accessions of wheat relatives. The same germplasm is being used to isolate a primary gene in the lignin biosynthesis pathway in wheat.

Impact:

Utilization of germplasm developed at the University of Idaho and the private sector has aided the development and evaluation of crops in Idaho. New crops or ornamentals for landscaping may also be developed after evaluation of the accessions for adaptation to the varied Idaho environments. Accessions of ancestors to crops grown in Idaho may lead to improved cultivars or improved management strategies to reduce the problems associated with transgenic crops.

Project Number: IDA01124

CRIS Number: 0174270

Goal: 1

Program: 1

RPA: 213

INTEGRATING BRASSICA COVER CROPS INTO POTATO CROPPING SYSTEMS

Investigators: Eberlein, C. V.

Termination Date: 06/30/2002

Reporting period: 07/01/1997 to 06/30/2002

Termination Report:

Previous studies in Idaho have shown that the combination of Brassica green manure incorporation followed by a low rate, postemergence herbicide application provided excellent weed control in potato. Additional studies were conducted to identify effective, low rate, postemergence herbicide treatments to use in combination with green manure incorporation. Rimsulfuron at 0, 9, 18, 26, and 35 g ai/ha was applied with nonionic surfactant (NIS), crop oil concentrate (COC), methylated seed oil (MSO), or silicone polyether copolymer (SIL) to potato infested with redroot pigweed, kochia, hairy nightshade, common lambsquarters, and volunteer oats. Average potato injury was less than 5% for all rimsulfuron rate and adjuvant combinations. Redroot pigweed was controlled 93% or better by all treatments except rimsulfuron at 9 g/ha + SIL. Weed control with rimsulfuron + SIL was less than with rimsulfuron plus MSO, COC, or NIS for all species except redroot pigweed. At lower rimsulfuron rates, weed control with rimsulfuron + MSO tended to be greater than with rimsulfuron + NIS or rimsulfuron + COC. Common lambsquarters control was 75% or less regardless of rimsulfuron rate or adjuvant. All rimsulfuron treatments had higher yields than the untreated check, but tuber yield with rimsulfuron + SIL was 18 to 37% lower than tuber yield in rimsulfuron + NIS or rimsulfuron + COC treatments. In contrast, tuber yield was 10 to 15% higher with rimsulfuron + MSO compared to rimsulfuron + NIS or rimsulfuron + COC.

Impact:

If a successful Brassica green manure system for potato can be developed, agrichemical use could be reduced and soil could be protected from wind and water erosion in winter and early spring.

Project Number: IDA01133

CRIS Number: 0174962

Goal: 1

Program: 1

RPA: 212

DETECTION, SEEDBORNE INOCULUM AND VIRULANCE OF ASCOCHYTA RABIEI

Investigators: Wiese, M. V.

Termination Date: 06/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Surveys of developing chickpea fields were conducted in 3 northern Idaho counties and in adjacent Whitman County, Washington, from May to August, 2001. While the vast majority of chickpea plants and fields remained free of *Ascochyta* blight, symptoms of the disease were detected in 6 fields in Nez Perce County, ID, beginning in late May. The causal fungus was confirmed as *Ascochyta rabiei* based on symptoms induced and the production of typical pycnidia and conidia at infections sites. Growers were advised of the occurrence of blight and the symptomatic fields and several adjacent fields without blight symptoms were sprayed with chlorothalonil fungicide. Resultant blight symptoms were largely held in check by the fungicide applications and no additional blight infested fields or plants were discovered. Resultant seed yields in infected and in blight free fields were normal or above average due to timely midseason rains.

Impact:

The fungicide applications applied to control *Ascochyta* blight again cost an average of \$15 per acre. However, most indiscriminate application of fungicide was avoided because vigilant field monitoring and drying weather conditions during pod development did not suggest a high risk of further pathogen spread and plant infection. Growers, however, petitioned for an additional fungicide to use in 2002 if necessary.

Project Number: IDA01137

CRIS Number: 0176624

Multi-State Project: W-185

Goal: 1

Program: 1

RPA: 211

BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS

Investigators: Johnson, J. B.

Termination Date: 09/30/2002 **Reporting period:** 01/01/2001 to 12/31/2001

Progress Report:

Interactions between biological control agents and resistant crop varieties remain an area of interest. Studies of entomophages attacking Russian wheat aphid, *Diuraphis noxia* (Mordvilko) (Homoptera: Aphididae) and other cereal aphids on resistant (IDO488) and susceptible (Centennial) wheat genotypes were completed. No significant differences, except in abundance of *D. noxia* and parasites of *D. noxia*, were found. An investigation on the effects of nitrogen fertilization rates and wheat resistance to *D. noxia* on *Scymnus frontalis* (Fabricius) (Coleoptera: Coccinellidae) was conducted. *S. frontalis* fed *D. noxia* reared on the resistant wheat variety '10085-5' took 0.4-1.3 days longer to mature, across three levels of nitrogen fertilization. These beetles were also slightly smaller, with eclosion weights 0.02-0.09 mg less than beetles fed *D. noxia* reared on susceptible 'Stephens' wheat. *S. frontalis* development was 0.3-2.0 days faster and beetles were 0.18-0.37 mg heavier when reared on wheat receiving 10% of the normal nitrogen fertilizer, across both wheat varieties. One new area of exploration involved the Hessian fly, *Mayetiola destructor* (Say) (Diptera: Cecidomyiidae), in northern Idaho. Studies examining the parasites present and the rates of parasitism will begin in 2002. The role of parasitoids in controlling pests in Brassica crops will also be considered in 2002. This will permit consideration of entomophage, e. g. *Diaeretiella rapae* (Hymenoptera: Braconidae), movement between crops.

Impact:

Understanding the interactions between biological pest control agents, resistant crop varieties and production practices is necessary to optimize biologically-based pest management. This knowledge will reduce pest management costs and environmental impacts of insecticide use. Expanding to include Brassica crops introduces a cropping system-wide perspective that may be important for some entomophages that move between crops.

Project Number: IDA01140**CRIS Number:** 0177349**Goal:** 1**Program:** 1**RPA:** 203**ROOTSTOCK, INTERSTEM, FERTIGATION, & STRAIN EFFECTS ON TREE GROWTH & DEVELOPMENT, NUTRITION****Investigators:** Fallahi, E.**Termination Date:** 06/30/2002**Reporting period:** 01/01/2001 to 12/31/2001**Progress Report:**

This project has three main objectives: Studying tree growth, nutrient partitioning, and postharvest physiology of 'Fuji' apple as influenced by: 1) various rootstocks and five fertigation

regimes; 2) inter-stem of 'Fuji' onto 'Rome' inter-stems; 3) root competition with various rootstocks and tree densities. The five-fertigation treatments are as follows: 1) 22.4 kg N/ha/year; 2) 89.7 kg N/ha/year; 3) 89.7 kg N/ha/year plus 78.5 kg K/ha/year; 4) 156.9 kg N/ha/year; 5) 156.9 kg N/ha/year plus 78.5 kg K/ha/year. Preliminary data also showed that mineral concentrations of leaves from various strains of 'Fuji' do not significantly vary. Trees from 22.4 kg N/ha zone had lower leaf N, leaf area, photosynthesis, and lower yield but better fruit color than those with higher N rates. Fruit from the high N treatment had higher evolved ethylene and respiration after storage. Four years after planting, trees on M.7 EMLA had higher yield than those on other rootstocks. Ottawa-3 had higher photosynthesis and better overall fruit quality than those on other rootstocks. Trees on B9 had lower leaf N, smaller fruit, and higher fruit Ca and higher evolved ethylene than those on other rootstocks. Trees on B.9 had the smallest tree Trunk Cross-Sectional Area(TCA) and the shortest limbs and terminal shoot. The density of non-flowering spurs in the scion trees increased with the vigor of rootstocks. Bud break in the mixed-buds of trees on of M.7 EMLA was slower than those on B.9 and O.3. Shoot and spur leaves, and fruit tissues of trees on M.7 EMLA had significantly higher K concentrations than those on other rootstocks. Shoot leaves and mixed-buds of trees on M.26 EMLA had higher Mg concentrations than trees on most other rootstocks. Trees of 2.43 m spacing had significantly higher photosynthesis than those of 1.22 m spacing. 'Fuji' fruit quality and mineral elements of trees were not affected by tree spacing.

Impact:

This project has provided fruit growers in the Pacific Northwest important information on the range of nitrogen fertilizer required for optimum quality when a micro-jet sprinkler is used. They also have a much better knowledge of rootstock effects on yield, growth and fruit quality in 'Fuji' apple.

Project Number: IDA01142

CRIS Number: 0177798

Goal: 1

Program: 1

RPA: 211

VARIATION IN SURFACE WAXES AND PREDATION IN PEAS AND OILSEED BRASSICA

Investigators: Eigenbrode, S. D.

Start Date: 01/01/1998 **Termination Date:** 06/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

During this granting period, the project has focused on the effects of pea surface waxes on three types of natural enemies attacking pea aphid 1) a fungal pathogen, 2) a parasitic wasp, and 3) ground-dwelling predatory beetles and their interactions with foliar predators. In work with the

fungal pathogen, *Pandora neoaphidis*, we have continued to show that reduced wax peas promote stronger infection by the fungus in the laboratory. We have shown that increased attachment by spores to reduced wax peas contributes to the greater infection. However, during the last two field seasons, we have not succeeded in producing significant infection levels in the field with the fungal isolate we are now using. This may be a serious limitation of the approach. A new isolate is more virulent and will be tried in the field this summer. In other work with this fungus, we have shown that adjuvant kaolin-based powders, applied to the plant surface to alter its properties, promote its infectious spread through the aphid population. The parasitic wasp, *Aphidius ervi*, produces higher levels of parasitism on reduced wax peas in the field and we have shown that this also occurs in the laboratory. The effect is most pronounced if the wasps have a choice between the two plant types, suggesting this is important in the field. We have shown that ground-dwelling predators (beetles in the family Carabidae) have a negative effect on foliar predators (Coccinellidae) in controlled cage studies. The wax phenotype of the plant in these experiments does not influence this negative interaction, but may dilute the impact of the direct effect of waxes on foliar predators which we have previously documented. In addition, we have monitored aphid colonization of peas in the field, finding evidence that the aphids colonize reduced wax peas less than normal wax peas. Lab experiments under way are designed to confirm this behavior by the aphid. We have made two steps towards application of the work. 1) The wax mutation *wsp* is being increased in isolines. The mutation is predicted to produce the same effects on predators and parasitoids as the mutation we currently use, but to be suitable for commercial varieties. One old garden variety of pea carries this mutation. 2) We isolated a new wax mutant that appeared in the existing commercial variety 'Majorette'. This is being increased for field trials. Together the work continues to show advantages of reduced wax peas for enhancing biological control of the pea aphid. Our emphasis is shifting towards identifying mutations that confer these advantages while maintaining adequate yield potential. To help with this, we continue to explore basic aspects of how plant waxes affect attachment and therefore effectiveness of natural enemies. This work was recently highlighted in a sponsored symposium on biological adhesion. This is significant because it represents interactions with the engineering community.

Impact:

We are developing a better understanding of how waxes affect beneficial carnivorous insects. The work spans basic investigations of the interaction between insects and plant waxes, how these interactions influence pest and beneficial populations in the field, and how wax variation can be included in cultivated varieties. Our aim is the development of productive crop varieties that enhance the action of natural enemies.

Project Number: IDA01144

CRIS Number: 0177726

Multi-State Project: W-185

Goal: 1

Program: 1

RPA: 211

BIOLOGICAL CONTROL IN PEST MANAGEMENT SYSTEMS OF PLANTS

Investigators: Baird, C. R.

Termination Date: 09/30/2002

Reporting period: 03/01/1998 to 09/30/2002

Termination Report:

The introduced European Lygus parasites, *Peristenus digoneutis*, were not released in Idaho during 2001 due to unavailability of adult parasites. No *P. digoneutis* were recovered from reared Lygus nymphs from Idaho in 2000 or 2001. The native Lygus parasite, *Peristenus howardi* Shaw, discovered and named earlier in this study, was found to parasitize over 80 percent of Lygus nymphs (determined by dissection) in late June 2000 and over 50 percent when nymphs are reared out from the University of Idaho Research and Extension Center alfalfa field at Parma, Idaho. During 2001, preliminary results indicate at least 60 percent of Lygus nymphs were parasitized in mid summer. Rearing results for 2001 are not yet available. Lower levels of Lygus parasitism (0 to 50 percent) were found in commercial alfalfa fields sampled by private researchers from June through August of 2001. In northern Idaho, preliminary sampling of Lygus bug nymphs indicated a low level of parasitism from a *Peristenus* species closely resembling *P. howardi*. Investigations are underway to find more efficient methods of assessing the level of parasitism so that surveys of other fields, crops and weeds can be evaluated for Lygus bug parasitism.

Impact:

Agricultural clientele are more aware of the Lygus parasite. Many growers have made conscious efforts to reduce spraying in alfalfa grown for seed to reduce the negative impact on *Peristenus howardi* populations. Technical assistance and support was provided to two private pest control consultants who are evaluating *Peristenus howardi* parasitism of Lygus in eight commercial fields of alfalfa grown for seed in southwestern Idaho. Parasitized Lygus bugs were swept from University of Idaho alfalfa fields by California Department of Food and Agriculture personnel during 2000 for the purpose of rearing and releasing in that state.

Project Number: IDA01153

CRIS Number: 0178481

Goal: 1

Program: 1

RPA: 203

DOMESTICATION OF WESTERN HUCKLEBERRIES

Investigators: Barney, D. L.

Start Date: 07/01/1998 **Termination Date:** 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Vaccinium membranaceum microcuttings were rooted in vitro and ex vitro using indole-3-butyric acid (IBA) and its potassium salt (KIBA). Amendment of culture media with IBA delayed rooting and increased root and callus dry weights, but did not increase survival after transplanting into potting soil. Dipping microcuttings into KIBA and returning them to unamended culture media reduced the time to in vitro rooting and increased root and callus dry weights. Dipping microcuttings into KIBA did not increase the percentage of ex vitro rooting. Untreated microcuttings had an average ex vitro rooting percentage of 92%. Micropropagated black huckleberry can be rooted either in vitro or ex vitro with acceptable ex vitro survival. Additional germplasm of *V. caespitosum*, *V. deliciosum*, *V. membranaceum*, *V. myrtillus*, *V. ovalifolium*, *V. ovatum*, *V. parvifolium*, *V. scoparium*, and *V. uliginosum* was collected from Oregon, Washington, Idaho, and Montana. Matching herbarium, DNA, and soil specimens were also collected. Breeding crosses were made using *V. membranaceum* and *V. ovalifolium* parents. During field trials in northern Idaho, *V. deliciosum* and *V. uliginosum* survived at significantly greater rates than did *V. membranaceum* and *V. ovalifolium* on relatively poorly drained silt loam soil. All species grew well in containers filled with peat moss-based potting soil. Clonal material is being propagated for replicated physiological/cultural studies and for distribution to cooperating growers for field trials.

Impact:

Domestication of western huckleberries offers the potential to provide commercial processors with reliable crops of high quality fruit at reasonable prices and reduce environmental damage from overharvesting wild stands. Reducing commercial processor reliance on wild stands should allow expansion of the industry and help protect the social and cultural huckleberry-related activities of Native Americans and other residents of the northwestern United States.

Project Number: IDA01154**CRIS Number:** 0178654**Goal:** 1**Program:** 1**RPA:** 212**MANAGEMENT OF RHIZOMANIA DISEASE OF SUGARBEET****Investigators:** Gallian, J. J.**Termination Date:** 06/30/2003**Reporting period:** 01/01/2001 to 12/31/2001**Progress Report:**

EFFECT OF SURFACTANT ON RHIZOMANIA DEVELOPMENT. Commercial surfactants and biosurfactants produced by some bacteria have been shown to reduce root diseases on

greenhouse crops caused by zoospore fungi by disrupting the zoospore membrane and causing cell lysis. The effect of a commercial surfactant on rhizomania development was tested. A soil penetrant manufactured by Naiad Company that has been effective for control of Phytophthora and Pythium diseases of several crops was added to daily irrigation solution for rhizomania susceptible sugarbeets grown in rhizomania infested soil in a controlled environment. Rates of surfactant were 50, 100 and 200 ppm ai. For the 50 ppm ai treatment, top weight was 64.1% higher than the untreated check, root weight was 102.1% higher, and ELISA readings for Beet Necrotic Yellow Vein Virus (BNYVV) were 27.8% lower than the untreated check. Results were similar for the 100 ppm ai treatment, but there was phytotoxicity in the 200 ppm ai treatment. These results suggest that surfactants may play a role in reducing infection by Polymyxa betae.

VARIETY TEST. Rhizomania resistant varieties adapted to the Idaho-eastern Oregon growing area were tested at Twin Falls on a field leased for rhizomania research. The field had been inoculated with rhizomania, and sugarbeets were grown in 2000 to establish the disease. In March, 2001, six inches of soil was removed by a commercial field leveling company, mixed, spread and leveled to uniformly distribute the disease inoculum. Twenty varieties plus 4 susceptible commercial check varieties were planted on April 26, 2001, to be tested for root yield and quality. Disease was uniform and moderate throughout the test, and all plots of susceptible check varieties showed clear symptoms of rhizomania. Average root yield of the 8 highest performing varieties was 8.98 tons/A greater than the average of the susceptible check varieties, and the estimated recoverable sugar for the top 6 varieties averaged 2997 lb/A higher than that of the susceptible checks.

GREEN MANURE FOR RHIZOMANIA MANAGEMENT. Previous field data indicates that oilseed radish (*Raphanus sativus*) that has been used as a trap crop for sugarbeet cyst nematode (*Heterodera schachtii*) may be beneficial for rhizomania management when soil incorporated as a green manure. To test this, two varieties of oilseed radish were planted August 15, 2001, at a seeding rate of 30 lbs/A and plowed down November 6, 2001, on a rhizomania infested field in a randomized complete block design with 8 replications and plots 33 x 100 ft. Soil samples were taken previous to planting for microbial assay, and additional soil samples for comparison will be taken prior to planting and following harvest. Sugarbeets will be planted in the spring of 2002. Yield and quality differences will be measured and disease ratings taken. The effect of the green manure crop on several soil physical properties will be measured.

Impact:

Using information developed by this project, growers continually reduce loss from rhizomania, and all commercial sugarbeet varieties for the Idaho and eastern Oregon market are now being developed by seed companies with rhizomania resistance.

Project Number: IDA01155

CRIS Number: 0179237

Goal: 1

Program: 1

RPA: 212

BIORATIONAL DISEASE CONTROL

Investigators: Chun, W. W.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

The Project Biorational Disease Control, has examined several new biological sources for potential development into disease management products. We have isolated three isolates of epiphytic bacteria from a sample of crucifer seed that suppressed black rot disease symptoms by *Xanthomonas campestris* pv. *campestris*. Preliminary identification by Biology and FAME has tentatively identified these cultures as *Stenotrophomonas maltophilia*, *Xanthomonas vesicatoria*, and a *Bacillus* spp. Coefficients of identity for *S. maltophilia* were low. *X. vesicatoria* coefficients of identity were high, thus decreasing its usefulness as an agricultural application. Additional tests for identification of the *S. maltophilia* and *Bacillus* isolates are underway. Epiphytically, we have been able to consistently demonstrate the ability of both isolates to prevent lesion formation when challenged with pv. *campestris*. Current efforts are now underway to determine the mechanism of disease suppression. In a separate project, we have identified two species of edible mushrooms that produce a nematocidal compound when grown on a rich nutrient medium. Under nutrient poor conditions, certain genera of fungi produce a tranquilizing factor (on nematodes), while others produce a nematocidal material. However, with all genera we examined, the nematocidal material is produced under nutrient rich conditions and at much higher levels than under nutrient poor conditions. We have determined the conditions and media composition to produce the maximum amount of activity in culture fluid in 14 days of standing culture. In all tests, effective dilutions of the culture media killed as much as 100% of J2 *Meloidogyne chitwoodi* larvae compared to 0% mortality with media controls. We have also determined that the level of nematocidal activity can be increased by the addition of vegetable oils that have a high monounsaturated fat content. We have also observed that saprophytic nematodes such as *Rhabditus* spp. are more sensitive than plant parasitic nematodes. We believe that it is related to internalization of the bioactive materials as stimulation of the feeding response in plant parasitic nematodes by the addition of fructose, increases mortality of the plant parasitic nematodes. Plant parasitic nematodes that we have shown to be sensitive are *Aphelenchoides* spp., *Xiphinema* spp., and *Trichodorus* spp. Thus, we believe that the nematocidal activity will not be genera limited. Several basidiomycetes were screened and two genera that displayed the highest activity in culture fluid assays against *M. chitwoodi* were selected as the production source of the nematocidal activity; *Laetiporus sulphureus*, and *Ganoderma lucidum*. We have completed the third year study in limited field trials with the enhanced strains of *P. corrugata* and have observed significant reduction in root rot incidence and severity on peas. This was accompanied by increases in yield of at least 40% in all trials. Thus, we have several biological alternatives for disease management in development.

Impact:

We expect to develop a commercial product from *P. corrugata* that will effectively control root rot in peas and other crops. Our work with the nematocidal materials from basidiomycetes could result in a new class of chemistries for disease management.

Project Number: IDA01156 **CRIS Number:** 0179776

Goal: 1

Program: 1

RPA: 211

BIOLOGY AND MANAGEMENT OF INSECT PESTS OF WHEAT IN IDAHO

Investigators: Bosque-Perez, N. A.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Research continues in two main areas: 1) Biology and management of wheat insects and 2) Host plant - virus - vector interactions. Field trials were conducted in 2001 to evaluate the incidence of Hessian fly under no-till (NT) and conventional till (CT) practices. The only differences in numbers of Hessian fly puparia were observed in July, when CT plots had 10 times the densities of NT plots. There were no differences in percent infested plants between the tillage treatments. Crop rotation may explain the large overall reduction in the Hessian fly population observed in 2001. The H3 resistance gene continued to exhibit effectiveness in controlling Hessian fly in the field. Evaluation of wheat breeding lines for resistance to Russian wheat aphid and Hessian fly continues as part of our collaboration with wheat breeders. Studies on host plant - virus - vector interactions included experiments to measure life history of insect vectors on healthy and virus-challenged plants of transgenic wheat and susceptible cultivars. Barley Yellow Dwarf Virus (BYDV) infection of susceptible wheat enhances the life history of the bird cherry-oat aphid. Aphid fecundity was greater in BYDV-infected wheat than on healthy plants. Aphid intrinsic rate of increase was higher in healthy plants than in virus-infected ones.

Impact:

This collaborative multidiscipline research has accelerated development of wheat varieties with genetic resistance to important pests.

Project Number: IDA01157

CRIS Number: 0181324

Goal: 1

Program: 1

RPA: 211

Factors Influencing the Acquisition, Transmission, and Spread of PLRV by Aphid Vectors

Investigators: Mowry, T. M.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Yellow pan traps, green tile traps, 6-foot tall solar-powered suction traps, and cylindrical sticky traps were evaluated for sampling winged green peach aphids at the Parma, Kimberly, and Aberdeen Research and Extension Centers. One hundred leaves from adjacent fields were checked for aphids at the same time that the traps were serviced. From the trapping devices, twice as many green peach aphids were collected in 2001 compared to the previous year. The number of aphids counted in the leaf samples far exceeded the numbers collected in the trapping devices and aphids were detected in the leaf samples before they were found in the pan or suction traps. In leaf samples from Parma, winged green peach aphids accounted for only 1.6% of total aphids counted. Given that green peach aphids were always detected first in leaf samples and the very low proportion of winged aphids in those samples, it is clear that field infestation and colonization occurs before winged aphids can be detected by any pan or suction trap. In Parma, first detection of winged aphids in leaf samples occurred in mid-July. These aphids were summer migrants whose populations are larger than those of spring migrants originating from peach and apricot trees. These results support the conclusion that pan and suction traps fail to detect winged green peach aphids in the spring and detect summer migrants too late to be useful for predicting local field infestation. The increase in green peach aphid populations in 2001 was confirmed by data from the Idaho Aphid Suction Trap Network showing that 12 aphids were collected in Parma, Kimberly and Aberdeen compared to only 5 in 2000. In Parma, three types of suction traps were in operation during 2001: one 40-foot tall electrically powered trap, one 25-foot tall electrically powered trap, and three 6-foot tall solar powered traps. For the entire season, 3, 3, and 6 green peach aphids were collected in these devices, respectively, and all were collected after aphids were found in leaf samples. These suction traps, differing in height, performed similarly in collecting green peach aphids and are not reliable predictors of local field infestation. Almost all green peach aphids collected on the sticky cylinders in Parma were on the northern arc of the trap. There were no commercial potato fields within two miles of these traps, but the prevailing winds in Parma come from the north and northwest. This indicates that green peach aphids may move long distances with the prevailing wind direction and that between-field movement is a potential threat. The leaf sample data from Parma revealed low green peach aphid densities in the first week of June, followed by two weeks when no aphids were detected after which densities peaked in mid-July. This indicates that spring migrants do not cause high green peach aphid densities, but that the highest infestations result from summer migrants. A bedding plant survey was conducted by examining plants for sale in commercial outlets throughout eastern and southern Idaho. Bedding plants remain a significant source of green peach aphids as infested plants were found in almost all locations.

Impact:

This second-year survey revealed that green peach aphids cannot be reliably detected prior to field infestation using winged-aphid sampling devices. Given that field sampling is used to trigger insecticide application, it is clear that other means of predicting the onset of green peach aphids are necessary for purposes of controlling the spread of PLRV. Certain phenological models may

prove more effective as green peach aphid management tools.

Project Number: IDA01160

CRIS Number: 0181680

Goal: 1

Program: 1

RPA: 205

RESIDUE AND ROTATION IN A SMALL GRAIN PULSE AND BRASSICA CROPPING SYSTEM

Investigators: Guy, S. O.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Field studies in 2001 included no tillage (NT) variety evaluations and sister variety evaluations conducted under conventional tillage (CT) management. However, due to genotype X environment interactions that occur with variety evaluations, this does not allow investigation of the interaction of variety with tillage systems. A study to investigate the tillage X variety interaction was initiated in 2000 and is a long-term study, carried into 2001 and projected to run for six years. Three crops are in rotation, dry pea, followed by wheat, and spring barley. The wheat is spring wheat due to rotation effects starting the study with winter wheat stubble and in 2000/2001 winter loss of the winter wheat stand that was replanted. In 2000 yields were lower for all crops in NT than CT, but there were no differences in 2001. There were yield differences among the 15 varieties of each of the three crops. There was an interaction of yield for tillage and variety in dry pea, with some varieties higher in NT than CT and some lower. Stand establishment was good with no differences between tillage treatments. Fertility and pest control were as needed and not factors in the experiment. Seed weights and test weights were higher in NT and reflect that the plants stayed greener longer in NT for a longer grain filling period. However, plant height and biomass was less in NT probably due to slower growth from the cooler environment. This combination of less biomass and long grain filling lead to lower wheat protein in NT, especially for the hard red spring varieties. This may indicate the need for increased nitrogen management in NT for protein purposes. Winter wheat varieties were planted for the 2002 season on the previous dry pea bulk planted area. The bulk areas are sites for other data collection including: beneficial and harmful insect differences between tillage treatments; soil physical, biological and moisture comparisons; and disease interactions. Another study evaluating date of planting and nitrogen fertility effects on yellow mustard was conducted and confirmed results from earlier studies. Early planting is important for yield and nitrogen management is also important for optimum yield and quality.

Impact:

Variety performance presented to growers allows them to select the best varieties for profitable

management of the farming system regardless of tillage practices. Knowledge generated about NT has facilitated adoption of the environmentally friendly practice by growers. Management information about yellow mustard has provided critical information for profitable production of this alternative crop in the Pacific Northwest.

Project Number: IDA01161

CRIS Number: 0181860

Goal: 1

Program: 1

RPA: 211

INTEGRATED MANAGEMENT STRATEGIES FOR ARTHROPOD PESTS OF HOP IN IDAHO

Investigators: Barbour, J. D.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

A Y-tube olfactometer was used to determine if feeding by *T. urticae* induces *H. lupulus* to produce volatiles that are attractive to *G. occidentalis* and/or *N. fallaciw*, two common predatory mites that prey on *T. urticae*. The olfactometer was modeled after a design presented by Sabelis and van der Bann (1983). Experiments involve pairing uninfested leaves with *T. urticae* infested leaves, mechanically damaged leaves, *T. urticae* alone and *T. urticae* webbing. The possibility of systemic production of attractive volatiles in hop is also under investigation. Results were analyzed using paired sample parametric or non-parametric tests as appropriate. Data indicate that both predatory mites are attracted to volatiles emitted from spider mite damaged hop leaves. The effect was greater for *N. fallacis* than for *G. occidentalis*.

Impact:

Data from this study provide a better understanding of the factors affecting effectiveness of predatory mites as natural enemies of spider mite in hop. In addition, they may prove useful in helping to devise means for increasing natural enemy effectiveness in hop and potentially other cropping systems.

Project Number: IDA01162

CRIS Number: 0181930

Goal: 1

Program: 1

RPA: 204

BROADENING GENETIC BASE AND DEVELOPING HIGH YIELDING EARLY MATURING BEAN

WITH RESISTANCE TO DISEASES**Investigators:** Singh, S. P., Forster, R. L.**Termination Date:** 06/30/2004 **Reporting period:** 01/01/2001 to 12/31/2001**Progress Report:**

The 24 advanced lines of great northern and pinto market classes were evaluated for Bean common mosaic virus (BCMV), common bacterial blight (CBB), drought, Fusarium root rot, rust, and general adaptation in ID, CO, ND, OR, WA, and Manitoba (Canada). Of these, six lines (five great northern and one pinto) resistant to BCMV and rust were evaluated in the Western Regional Bean Trial (WRBT) and North American Cooperative Dry Bean Nursery (CDBN). None of the lines were superior to previously released great northern (UI 465) and pinto (UI 320) cultivars. Evaluation of 25 medium-seeded cultivars released between 1930 and 1998 on-farm and experimental station, 20 cultivars for drought stress, and 16 cultivars for response to soil zinc deficiency was completed. Four single crosses, three double crosses, and seven multiple-parent broad-based populations were developed for pyramiding complementary genes for individual, as well as multiple agronomic traits for great northern and pinto cultivars. More than 1500 F1 plants from multiple-parent crosses were screened in the greenhouse for BCMV and CBB. Approximately 4000 F1- or F2-derived early generation (F2 to F5) families/lines from multiple-parent populations were evaluated at Kimberly and/or Parma. Plant type, maturity, general adaptation, and seed characteristics were used as selection criteria.

Impact:

None to report.

Project Number: IDA01166**CRIS Number:** 0182465**Goal:** 1**Program:** 1**RPA:** 212**VARIABILITY AND EVOLUTION OF POTYVIRUSES****Investigators:** Berger, P. H.**Termination Date:** 06/30/2004**Reporting period:** 01/01/2001 to 12/31/2001**Progress Report:**

The purpose of this project is to study evolution of plant viruses, particularly viruses in family Potyviridae. Under the auspices of this project, a more general objective is characterization of viruses of importance to Idaho and US agriculture, as well as development of methods for their

control, particularly using biotechnological approaches. There are several specific research projects intended to address the above objectives. 1) Characterization and detection of isolates of Potato virus Y (PVY) novel or exotic to the Pacific Northwest. At least two and possibly more isolates of PVY have been observed in the PNW. We are in the process of confirming the precise identity of these isolates and developing methods for their detection. Related to this project is work aimed at developing high throughput diagnostic methods for a range of potato viruses, with an aim towards eventually transferring this technology to state certification agencies. 2) Development of transgenic wheat with virus resistance. This work emphasizes wheat cultivars grown in the PNW. We have created winter wheat with coat protein-mediated resistance to barley yellow dwarf virus (BYDV) and to wheat streak mosaic virus (WSMV). Work underway includes field testing of potentially useful selections, and utilizing and/or developing methods to reduce or eliminate transcriptional gene silencing. Work is also progressing on studying the relationship between transgenic wheat and effects on virus-vector interactions. 3) Development of transgenic peas with virus resistance. This work emphasizes grain legumes typically grown in the PNW. We have extensive laboratory, greenhouse, and field data on peas with coat protein-mediated resistance to Pea enation mosaic virus (PEMV), and non-pathogen-derived resistance to both PEMV and pea streak virus. Work is in progress to provide detailed molecular genetic information on selected lines and to complete a third year of field testing. 4) Molecular evolution of potyviruses. This work is described in the CRIS report for IDA09904-CG.

Impact:

The work on potato virus detection will impact the cost and effectiveness of potato seed certification. The work on PVY will also impact seed certification, and could also facilitate export of US potato seed. Development of virus resistant wheat will decrease the cost of production as well as decreasing yield loss due to BYDV and WSMV. A similar benefit would be realized with resistance to virus diseases in peas.

Project Number: IDA01167

CRIS Number: 0183922

Goal: 1

Program: 1

RPA: 212

RESEARCH TO CONTROL ROOT DISEASES OF WHEAT AND BARLEY

Investigators: Forster, R. L.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

A survey of root diseases (Rhizoctonia root rot, common root and foot rot caused by Fusarium and Bipolaris spp., and take-all) was conducted in 69 non-irrigated wheat and barley fields in 12

southeastern counties where minimum-tillage or no-till practices were employed or may be employed in the future. These diseases were detected in 100, 90, and 16% of the surveyed fields (based on symptoms and/or isolation) with mean/maximum disease severity indices of 9/36, 16/56, and 2/6, respectively. Significantly more ($P=0.01$) common root and foot rot was detected in plants in reduced tillage fields compared to conventional tilled fields, whereas there was a tendency ($P=0.07$) for less *Rhizoctonia* root rot to occur in plants in reduced tillage fields. Eighteen soft white spring wheat cultivars and breeding lines were also evaluated for *Rhizoctonia* root rot and common root and foot rot in a nursery in Soda Springs, ID. Significant differences in common root and foot rot were detected but not in *Rhizoctonia* root rot. Soil samples were also collected from the same fields for nematode assays. *Paratylenchus* sp., *Pratylenchus neglectus* and *P. thornei*, and *Tylenchorhynchus* sp. were detected in 10, 100, and 83% of the fields with mean/maximum numbers of nematodes per 100 g of soil of 229/1440, 146/1059, and 64/1618, respectively. A three-year field study comparing the effects of crop rotations and tillage practices (direct seeding and conventional tillage) on root disease development and yield will be initiated in April 2002 at two sites in eastern Idaho. The role of mycorrhizae in wheat and barley production will also be evaluated.

Impact:

None to report.

Project Number: IDA01171

CRIS Number: 0182652

Goal: 1

Program: 1

RPA: 213

DEVELOPING MORE EFFECTIVE WEED MANAGEMENT SYSTEMS FOR SUGARBEET

Investigators: Morishita, D. W.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Weed control studies conducted in sugar beets included the evaluation of micro herbicide rates with and without triflurosulfuron and substituting higher rates of ethofumesate. Kochia was not satisfactorily controlled without triflurosulfuron even when using higher ethofumesate rates. Producers faced with controlling ALS resistant kochia will be recommended to use ethofumesate preemergence followed by two to three applications of desmedipham & phenmedipham & ethofumesate plus clopyralid at normal use rates. Dimethenamid-P was evaluated for weed control when used in combination with existing postemergence broadleaf herbicides.

Dimethenamid-P was applied at several application timings including cotyledon, 2 leaf, and 4 leaf growth stages. Some grass and broadleaf weed control was improved with the addition of dimethenamid-P. It is believed that the addition of this product will provide growers with an additional weed management tool for economical control of weeds in sugar beets. Volunteer potato growing in sugar beet can be an especially difficult weed problem depending on the year. A study was conducted to evaluate registered and candidate herbicides for control of volunteer potato in sugar beet. The standard herbicide treatment of desmedipham & phenmedipham & ethofumesate plus triflurosulfuron plus clopyralid applied at normal use rates controlled volunteer potato as effectively as other herbicide treatments. Other treatments included using increased clopyralid rates or increased ethofumesate rates or adding fluroxypyr to the third application of desmedipham & phenmedipham & ethofumesate plus triflurosulfuron. Glyphosate also was applied as a wick application and controlled volunteer potato better than any other herbicide treatment. Control of volunteer potato is important to reduce the potential of early blight or late blight transmission.

Impact:

By developing a better understanding of the behavior of herbicides for the control of weeds in sugar beets, growers will be able to use them more effectively and efficiently. In addition, research on the control of atypical weeds such as volunteer potato is important from a disease management standpoint in potato production.

Project Number: IDA01173

CRIS Number: 0184330

Goal: 1

Program: 1

RPA: 212

SEED POTATO QUALITY IMPROVEMENT

Investigators: Nolte, P.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Research comparing the performance of cut potato seed to that of uncut seed has been ongoing for the last seven years. Over the seven-year period, research indicates that use of whole seed did not result in an increase in yield over cut seed, when cut seed was treated with seed treatment fungicides fludioxanil or thiophanate-methylplus mancozeb. Whole seed actually had higher levels of seed decay and stem/stolon canker caused by *Rhizoctonia solani* than the cut and treated seed. This research indicates that seed treatment may be required on whole seed if seed decay conditions are favorable or *Rhizoctonia* is a concern.

Impact:

This work has provided potato producers with a better understanding of the advantages and disadvantages of whole seed vs. cut seed and will allow them to manage their operations to maximize the advantages.

Project Number: IDA01174 **CRIS Number:** 0185583

Goal: 1

Program: 1

RPA: 202

PLANT REGENERATION TECHNIQUES AND GENETIC TRANSFORMATION OF LANDSCAPE AND FLORAL PLANTS

Investigators: Tripepi, R. R.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

We have completed projects in micropropagation and genetic engineering. Plant Preservative Mixture, a broad-spectrum preservative and biocide for use in plant tissue culture, was evaluated as an alternative to using conventional antibiotics and fungicides. Concentrations of 0.5 to 4.0 mL/L were tested with leaf explants of 'Iridon' chrysanthemum (*Dendranthema x grandiflora* Kitam), European birch (*Betula pendula* Roth), and rhododendron (*Rhododendron catawbiense* Michx.). Plant Preservative Mixture had little effect on the percentage of explants forming shoots and the number of shoots formed per explant for birch and rhododendron but dramatically reduced both responses by chrysanthemum explants, even at a level as low as 0.1 mL/L. In another study, *Lewisia cotyledon*, a perennial native to the mountainous areas of the western United States, was micropropagated using the lower axillary buds from flower peduncles. Successful establishment in tissue culture was genotype dependent. DKW medium supplemented with 3.5 microM BA appeared to be a better basal medium for increasing and maintaining in vitro rosettes than either MS or WPM supplemented with the same BA concentration. Tissue cultured rosettes were rooted in vitro using MS supplemented with 0, 0.5, 1.0, 1.5 or 2.0 microM NAA, IBA or IAA. Rooted rosettes were successfully transferred to a growth chamber or growth room and were phenotypically normal. Genetic transformation research this past year involved using the biolistic DNA-delivery system on leaves from several cultivars of *Rhododendron catawbiense*. A number of parameters, such as the DNA load, particle flight distance and pressure at which the particles are delivered into the leaf tissue or explant, were tested on only the cultivar 'Album'. 'Iridon' mum leaves were used as the positive control. The plasmid used was a commercially sold vector from CAMBIA and is called pCAMBIA2301. Leaf explants were assayed for GUS two days after shooting. About 50% of the mum leaf explants transiently expressed the GUS gene, but blue spots, indicating GUS activity, were always absent on 'Album' rhododendron leaves. Low

percentages of leaves from the cultivars 'PJM' and 'Cunningham's White', however, did transiently express GUS after being bombarded. In another study, the circular plasmid was made linear with restriction enzymes. Rhododendron leaf explants bombarded with circular DNA had few, if any, leaves transiently express the GUS gene, but 10 to 40% of those bombarded with linear DNA transiently expressed GUS. In addition, the cultivars 'PJM', 'Cunningham's White' and 'America' were the only ones to express the GUS gene. 'Iridon', 'PJM', and 'Cunningham's White' leaf explants were also bombarded with 1, 2, 4, 8, or 16 micrograms/mL of DNA to determine the optimum concentration to use in experiments. The optimum DNA concentration for 'Iridon' leaves was 8 micrograms/mL, whereas 2 micrograms/mL of DNA was the optimum concentration for both rhododendron cultivars.

Impact:

Development of micropropagation technology for *Lewisia* will enable growers to produce large numbers of unique hybrids rapidly for the home landscape. Growers can patent their unique plants allowing them to enhance profits from their breeding efforts. In our attempts to insert genes into rhododendron, making the plasmid vector into linear DNA has markedly improved the chances for successfully inserting foreign genes into rhododendron beyond the low rate (0 to 0.2% success) reported by others.

Project Number: IDA01175

CRIS Number: 0184052

Goal: 1

Program: 1

RPA: 204

DEVELOPING IMPROVED SOFT WHITE WINTER WHEAT CULTIVARS FOR THE PACIFIC NORTHWEST

Investigators: Zemetra, R. S.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

The advanced line ID-B-96 was released as the cultivar 'Brundage 96'. It is a high yielding, moderately short semi-dwarf wheat with good to excellent end-use quality. Brundage 96 is most similar to the cultivar 'Brundage' except it has better stripe rust resistance and is 2-3 days later flowering than Brundage. A greenhouse screening method was developed to simultaneously screen for *Pseudocercospora* foot rot resistance and improved winter-hardiness in early generation (F2) populations. A second cycle of selection is being done on F3 families of survivors to confirm improved disease resistance and winter-hardiness. Backcrossing has been used to incorporate non-transgenic herbicide resistance into soft white winter wheat cultivars. Transgenic

wheat developed in the breeding program for resistance to Barley Yellow Dwarf Virus (BYDV) and Wheat Streak Mosaic Virus (WSMV) continues to be tested in the field for economic levels of resistance. Transgenics for BYDV resistance have performed better in the field than WSMV transgenics to date. The second year of a study to compare the agronomic performance of soft white wheat cultivars under conventional and direct seed cultivation was completed and no interactions between cultivar and tillage method were observed. A new study involving the modification of the level of lignin in wheat straw to increase cellulose accessibility was initiated.

Impact: The results of this research could lead to improved profitability of wheat producers in the Pacific Northwest by increasing wheat grain production, reducing input costs and potentially making wheat straw a salable commodity for PNW producers.

Project Number: IDA01183

CRIS Number: 0184842

Goal: 1

Program: 1

RPA: 201

DEVELOPING SUPERIOR OILSEED AND MUSTARD CULTIVARS FOR BRASSICACEAE

Investigators: Brown, J.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Acreage of 'IdaGold' condiment yellow mustard continued to increase throughout the region. A third foundation to certified seed increase was accomplished. The first commercialization of 'Pacific Gold', oriental mustard was completed with good success. Despite a late planting (early June) as seed arrived back from Yuma, Arizona, later than expected, seed yields averaged over 1700 lb/acre and several fields exceeded 2000 lbs/acre. All commercial seed was shipped to Japan and the initial reports of quality are good. Foundation seed of 'Athena', winter canola was produced 2000/2001 and for evaluation certified seed was planted near Genesee, Idaho this fall. Limited commercial production was also planted this fall. Breeders' seed was produced for 'Clearfield-Sunrise' (spring canola) and 'Clearfield-Sterling' (spring rapeseed). These are this project's first two herbicide (Raptor) resistant cultivars. The first stage in a continuing investigation into breeding methodology was completed and results are under review. A third round of intergeneric hybridization using Brassica juncea, B. nigra, B. rapa, and Sinapis alba was completed. Insect resistant germplasm from canola x yellow mustard hybrids have been identified. Breeding lines were identified with low polyunsaturated oils suitable for low NOx Biodiesel development.

Impact:

Availability of Pacific Gold oriental mustard and Athena winter canola will offer Pacific Northwest growers more crop rotation benefits and will enhance domestic and export markets for these alternative crops. Canola- and rapeseed-quality yellow mustard lines will greatly increase the US acreage of these oilseeds. High glucosinolate intergeneric hybrids could have a tremendous impact as an alternative to synthetic soil fumigation.

Project Number: IDA01185
CRIS Number: 0185584
Multi-State Project: NE-124
Goal: 1
Program: 1
RPA: 212

GENETIC MANIPULATION OF SWEET CORN QUALITY AND STRESS RESISTANCE

Investigators: Mohan, S. K.

Termination Date: 09/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Two sweet corn varieties, viz., Even Sweeter (sh2) and July Gold (se) were used to evaluate 14 seed treatments for their efficacy in improving stand at different locations. Results (as percent final stand at 4-5 leaf stage) were received from 21 locations in the U.S. and one location from Japan. Final stands in the untreated check of Even Sweeter varied from 10 to 66%, and of July Gold from 4 to 69% among the locations. Best treatments in several locations produced stands up to more than 10 times higher than the untreated check. In most locations, the standard protectant treatment (Captan + Thiram + Allegiance) increased the stand, but no further benefit was observed with the addition of a systemic fungicide (Flo-Pro Imz or Dividend). Polymer seed coating did not improve performance of the fungicide treated seed. There was no difference between the two systemic fungicides, Flo-Pro Imz and Dividend, or between the protectants Maxim and Captan + Thiram.

Impact:

Data from different sweet corn growing regions on the performance of different fungicide mixtures on the two sweet corn genotypes provide a rational basis for the seed companies in selecting the appropriate and economical seed treatment combination for each region.

Project Number: IDA01186
CRIS Number: 0183486
Goal: 1
Program: 1

RPA: 204

SEED POTATO PERFORMANCE

Investigators: Olsen, N.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Plant growth and weather information for the cultivars 'Russet Burbank', 'Ranger Russet', 'Umatilla Russet', 'Shepody', and 'Russet Norkotah' were monitored in the seed-growing areas of Idaho in 1999, 2000, and 2001. Accumulated air and soil heat units from tuberization to harvest were used to determine temperature exposure and impact of differing seed growing seasons on seed performance. In the 2000 seed growing season, seed tubers accumulated more heat units compared to the 1999 season. The influence of the different growing seasons was evident in seed sprouting and response to seed storage treatments. At harvest, seed tubers were transported to the Kimberly Potato Storage Facility and placed in storage. Seed storage treatments include: a) 3.3C until planting, b) 3.3C followed by 1 month at 7.2C prior to planting, and c) 3.3C followed by 2 weeks at 15.6C prior to planting. More advanced sprouting was seen in the 3.3C and 15.6C treatment (2-6 cm) and the least with seed stored at 3.3C (0.2-2 cm) prior to planting. Seed tubers stored at 3.3C were evaluated throughout the storage season for dormancy break and sprout development. All cultivars, except 'Umatilla', initiated sprouting and reached 80% peeping (dormancy break) earlier in the 00/01 season compared to the previous season (99/00) most likely due to the greater accumulation of heat units during the seed growing season. Aging 'Russet Burbank' seed did not influence emergence, but did increase above-ground stem numbers. 'Ranger Russet' was the only cultivar in 2001 that did not exhibit typical physiological age characteristics in the field due to the storage treatments for there was no difference in emergence or above-ground stem numbers. 'Umatilla Russet', 'Shepody', and 'Russet Norkotah' responded to one or both elevated seed storage temperatures by exhibiting an increased rate of emergence and increased above-ground stem numbers. Only 'Russet Burbank' undersize (<4 oz.) yields increased due to both aging treatments while the remaining size profiles and yields were not altered. After evaluating two years of data, it appears 'Ranger Russet' will require longer and/or higher seed storage temperatures to affect emergence, stem number, size profile and yield. 'Umatilla Russet' showed trends in the aging treatments with increased yields in the 6-10 oz. size range, and total yields were significantly greater with the 3.3C and 7.2C storage treatment. Only trends for 'Shepody' were observed with an increase of tubers sized 6-10 oz. and US1 yields in the 3.3C and 7.2C treatment. 'Shepody' also showed a trend towards greater total yields due to both elevated seed storage treatments. 'Russet Norkotah' size profile and yields were not influenced by seed age treatments in 2001. In general for the 2001 season, although sprout development and stem numbers were elevated due to physiological aging by the seed storage treatments, those affects on yield and size profile were minimal. In some years, early growth due to aging would be beneficial especially if final yield and quality were not affected.

Impact:

This study has demonstrated that cultivars respond differently to the seed storage treatments and provides information on how to manage seed for early growth, yields and yield profiles. Continued efforts will allow a better understanding of the influence of season and manipulating seed performance.

Project Number: IDA01189

CRIS Number: 0184325

Goal: 1

Program: 1

RPA: 204

ENVIRONMENTAL EFFECTS ON FORAGE QUALITY AND TESTING FOR THE DIFFERENCES

Investigators: Shewmaker, G. E.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

This completes the second year for data gathering, some sites have 3 years data. Study will be continued next year. Preliminary results indicate that alfalfa grown under irrigation in Camas County increased in acid detergent fiber (ADF) 2.7 percent and crude protein decreases 1.4 percent each week in June. Forage yield and quality functions can be developed from this data for each site and correlated with the AgriMet weather data. Cooperation with other states is being developed in order to do chemical forage quality determination and to share samples for Near-Infrared Reflectance Spectrophotometer calibration. This will allow more rapid and cost effective analysis of additional samples.

Impact:

This research will lead to the development of a decision aide for producers to evaluate whether their goal will be for high quality, high yield, or optimize both yield and quality of forage, given their management options, markets, and weather. Producers will be able to better determine profitability for forage production, and forage feeders will be better able to predict animal performance.

Project Number: IDA01200

CRIS Number: 0185086

Goal: 1

Program: 1

RPA: 211

BIOLOGICALLY BASED MANAGEMENT OF THE CABBAGE SEEDPOD WEEVIL ASSOCIATED WITH OILSEED RAPE IN IDAHO

Investigators: McCaffrey, J. P.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Aphids and other late season pests are limiting factors to the success of profitable spring canola production. Extended insecticidal effects of the seed treatments, Helix Xtra and Gaucho, may reduce aphid populations later in the season. Such claims need to be verified if costly seed treatments are to be included in integrated pest management programs for spring canola. Plants damaged by flea beetles early in the season may weaken the plants and significantly reduce their ability to compensate for late season insect damage. Thus, beyond killing aphids via the extended insecticidal effects of seed treatments, the seed treatments could also lead to enhanced plant tolerance as a cultural control to any late season insect attack, including diamondback moth and cabbage seedpod weevil. We assessed these hypotheses in small plots (3.5' x 16') of spring canola planted in a random block design with four replications of each treatment at Moscow, Idaho on May 18, 2001. Treatments consisted of 1) Helix Xtra (400 g A.I./100 kg seed), 2) Helix Xtra (800 g A.I./100 kg seed), 3) Gaucho (600 g A.I./100 kg seed), 4) Gaucho (1,200 g A.I./100 kg seed), 5) Sevin (0.5 A.I./acre) (May 25 & June 7), 6) Sevin (0.5 lb A.I./acre) (May 25 & June 7) and Capture (0.04 lb A.I./acre) (July 13), and 7) no insecticide treatment as a control. Flea beetle damage to cotyledons were scored using a 0-6 rating system. Insect bucket counts were conducted to assess numbers of cabbage seedpod weevil, flea beetles, Lygus and diamond back moth (two counts per plot). Aphid pressure was determined by counting the number of racemes with aphids (30 racemes visually inspected/ plot). Plots were harvested for yield on September 4. The yields of all seed treatments were lower than the Sevin/Capture treatment regime. Flea beetle injury was minimal across treatments and the effects of seed treatments on the ability of spring canola to tolerate late season pests were not clear. Aphid populations were still in high populations in spite of any early season flea beetle control; thus, the claim that insecticide treated seed for flea beetle control gives season-long aphid control was not supported by our study. This is especially important given the high costs of seed and foliar treatments. If the seed treatment alone cost \$8.00/ac then at least 67 lbs/acre of seed would have been necessary to cover the cost of treatment with price returns of \$0.12/lb of seed. This was generally found in this study. However, flea beetle pressure was not high and seed treatments gave no increased yield or aphid control. Aphid control was only evident with the late season Capture treatment and this was reflected in a higher yield. The diamondback moth which was controlled by the late season Capture spray only. This study does not support the claim that seed treatments of canola can lead to late season aphid control.

Impact:

These data suggest that expensive seed treatments may not lead to significant control of late season pests, including aphids.

Project Number: IDA01201

CRIS Number: 0185427

Goal: 1

Program: 1

RPA: 213

MANAGING HERBICIDE-RESISTANT PLANTS IN DIRECT-SEED DRY LAND WHEAT PRODUCTION SYSTEMS IN THE PACIFIC NORTHWEST

Investigators: Thill, D. C.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Two herbicide resistant crop-weed management studies were initiated in fall 2000. Herbicide resistant crop technology is compared to standard herbicide practices in a 2-year and a 3-year rotation. Imidazolinone resistant winter wheat, spring canola, and spring wheat were direct-seeded, superimposed on a previous experiment that had 2- and 3-year rotations for 6 years. Imazamox was applied in the herbicide resistant treatment, and typically prescribed herbicides for the species present were applied in the standard herbicide treatment. Weeds were counted before and after application and total plant biomass by species at wheat heading was taken from three 0.5 square-m areas within each experimental unit. Crops were harvested at maturity to determine canola seed and wheat grain yield and wheat test weight. Winter wheat yield was 4512 and 4641 kg per ha, canola seed yield was 1436 and 1508 kg per ha, and spring wheat yield was 2624 and 3220 kg per ha in the resistant and standard herbicide treatments, respectively. Winter wheat yield was 5562 and 4691 kg per ha and canola yield was 1438 and 1504 kg per ha in the 2-year and 3-year rotations, respectively. Final analysis will be in 2006 after three cycles of the 2-year and two cycles of the 3-year rotations. A second experiment is the continuation of a five-year herbicide resistant enrichment study. The treatments include a combination of 'on' and 'off' year for group two herbicides. Five plots were treated pre-plant with the group two herbicide imazethapyr ('on' year) and the check plot was treated with metribuzin (non-group two). Spring pea was direct-seeded and the check plot was treated post-emergence with bentazon (non-group two). Pea seed yield ranged from 439 to 787 kg per ha. Herbicide resistant weed biotype selection will be determined at the end of the study in 2005. Experiments were established in spring 2000 and 2001 near Moscow, ID at the University of Idaho Parker Research Farm and near Ralston, WA at the USDA Ralston Direct Seed Project site to evaluate alternatives to traditional glyphosate treatments for control of volunteer herbicide resistant crops (HRC). Glyphosate resistant spring wheat (RRW), glyphosate resistant canola (RRC), imidazolinone resistant wheat (CFW), imidazolinone resistant canola (CFC), and glufosinate resistant spring canola (LLC) were seeded with a no-till drill to simulate volunteer HRC. At 14 days after treatment (DAT), RRW was controlled 93 percent by paraquat plus diuron. By 21 DAT, control was best (90 to 95 percent) with paraquat plus diuron and treatments containing clethodim or quizalofop. At 21 DAT, CFW

was controlled 93 to 97 percent by quizalofop, clethodim, paraquat plus diuron, and all glyphosate treatments except glyphosate in combination with glufosinate or paraquat (66 to 79 percent control). RRC was controlled 98 percent by paraquat plus diuron 28 DAT. At 28 DAT, control of CFC and LLC ranged from 94 to 98 percent with paraquat plus diuron and all glyphosate treatments except glyphosate in combination with glufosinate (CFC only) or paraquat (67 to 88 percent control).

Impact: Findings from this research allow farmers to effectively control weeds in direct-seed, dry land wheat production systems, which will result in greater adoption of conservation tillage practices and ultimately reduce soil erosion. Another outcome of this research is weed control strategies to prevent or minimize selection of herbicide-resistant weeds in dry land wheat cropping systems. This research provides information on effective control of herbicide-resistant volunteer crops and indicates which herbicides can be used in place of glyphosate to control weeds and volunteer crops during fallow periods of the cropping cycle, thus reducing the potential for weed species shifts and/or selection of glyphosate-resistant weed biotypes.

Project Number: IDA01223

CRIS Number: 0189718

Goal: 1

Program: 1

RPA: 206

REGULATION OF FUNGAL MORPHOGENESIS AND MULTICELLULAR DEVELOPMENT

Investigators: Miller, B. L.

Termination Date: 06/30/2006

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

During the past year we have continued work to characterize three genes/proteins essential for development in filamentous fungi. 1)The *bncA1* (binucleated conidia) allele is a single mutation located on chromosome IV that causes formation of approximately 25% binucleate and 1% trinucleate conidia. *bncA1* conidia exit G1 arrest earlier than the wild type. Germlings have abnormal morphology, randomly distributed nuclei and an irregular septation pattern. Older hyphal elements undergo catastrophic mitosis suggesting the nuclear division cycle of internal elements is not arrested. The *bncA1* mutation causes aberrant morphogenesis of the asexual reproductive structure. Cell types that are normally uninucleated (metulae and phialides) are elongated with incorrect numbers of nuclei and internal septation. Consistent with defects in cell cycle regulation and nuclear movement, the *bncA1* mutant showed hypersensitivity to the anti-microtubule drugs thiabendazole and nocodazole. Therefore, *bncA* has an important role in correctly regulating both the cell division cycle and nuclear movement. 2)Structure/function studies of *sterileA* (*steA*) have shown identified the DNA sequence to which this protein binds, a

transcriptional activation domain for regulating gene expression and two C2/H2-Zn finger binding domains. The latter domain however do not bind DNA but are presumed to be involved in protein-protein interactions. Deletion of this domain results in reduced conidiation and highly elevated sexual reproduction. Efforts are underway to identify interacting proteins. 3)stunted (stuA) regulates both the asexual and sexual reproductive cycles. We have identified a novel StuA-interacting protein that apparently is specific to filamentous fungi. No homologs have been identified in any other organisms. We are currently characterizing this gene and its biological function. 4)We have continued our work with dopey (dopA). This gene encodes the founding member of a novel family of large proteins found in all eucaryotes (with the exception of plants). DopA homologues have critical roles in establishing cell morphology and pattern formation in those organisms which have been investigated. The dopA1ts mutation causes aberrant cellular morphology of all cell types, asynchronous cell pattern formation and the loss of both asexual and sexual reproductive cycles. By contrast, we have found that dopA and budding yeast DOP1 null alleles are lethal. The C. elegans homologue PAD-1 is also an essential gene and a null allele is embryo lethal. Finally, there are at least two human dopA homologues that have been described. One of these, HC21orf5, shows highest expression in differentiating neuronal cells of the developing central nervous system. We are proposing that DopA is a novel and essential component of cellular protein trafficking required for developmental and morphological signaling. This is based upon our observations that a)expression patterns of key transcriptional regulators of the asexual and sexual reproduction are altered in the dopA1ts mutant, b)dopA interacts genetically with rasA and c)DopA protein localizes to the trans-Golgi network (TGN) and/or endosomes.

Impact:

Cellular and developmental morphogenesis during the asexual and sexual reproductive cycles of the filamentous fungus *Aspergillus nidulans* requires precise coordination between development-specific and cell cycle specific gene regulation, and alterations in cell polarity (cell shape) and nuclear movement. These same regulatory events are required in all filamentous fungi, be they plant or animal pathogens or agents of post harvest crop losses. The genes and encoded proteins that we are studying are essential regulators of these processes. Outcomes will include the elucidation of novel environmental signaling pathways and the genetic regulatory pathways controlling development in fungi. Of broader interest are the identification of novel process common to all eucaryotic organisms.

Project Number: IDA01212

CRIS Number: 0185241

Goal: 1

Program: 1

RPA: 205

VARIABLE RATE NUTRIENT AND IRRIGATION MANAGEMENT FOR SUSTAINABLE CROPPING SYSTEMS IN SOUTHERN IDAHO

Investigators: Stark, J. C.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

A study was conducted at the University of Idaho, Aberdeen Research and Extension Center to evaluate site-specific responses of potatoes to phosphorus fertilization. The experiment was conducted in a 5 acre field on a Declo silt loam soil with a pH range of 7.9 to 8.2. Prior to planting, the field was divided into eighteen, 0.22 acre grids (120 ft x 80 ft). Soil samples from each grid were collected and analyzed separately to provide site-specific soil nutrient concentrations. Sodium bicarbonate-extractable P concentrations for the 18 grids ranged from 7 to 16 ppm, while excess lime ranged from 6 to 16%. Triple superphosphate (0-45-0) was broadcast-applied to randomized 20 ft x 80 ft strips within each grid at 0, 80, 160, 240, 320, or 400 lb P₂O₅/ac and incorporated with a disk. Total tuber yields for all subplots within the 18 grids ranged from 162 to 403 cwt/ac with a field average of 312 cwt/ac. By comparison, U.S. No. 1 yields ranged from 100 to 264 cwt/ac. Regression analysis was used to determine optimal P fertilizer rates for each grid. The optimal P rate for the entire field was 319 lb P₂O₅/ac. However, optimal P rates for individual grids ranged from 239 to 400 lb P₂O₅/ac. Optimal P rates for the 18 grids were generally within +/- 20 % of recommended rates determined from University of Idaho guidelines.

Impact:

This research demonstrated that optimal P fertilizer rates for potatoes can vary substantially even within a relatively small field. The work also demonstrated that the University of Idaho P recommendations developed from conventional fertilizer trials did a reasonably good job of estimating optimal P rates. However, additional refinements in P fertilizer response calibrations will need to be made to more fully realize the potential benefits of site-specific fertilization in potatoes.

Project Number: IDA01214

CRIS Number: 0186863

Multi-State Project: W-150

Goal: 1

Program: 1

RPA: 201

GENETIC IMPROVEMENT OF BEANS (*PHASEOLUS VULGARIS L.*) FOR YIELD, PEST RESISTANCE AND FOOD VALUE

Investigators: Singh, S. P.

Termination Date: 09/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

The 10 single and 5 double crosses were made for pyramiding resistance to drought, soil zinc (Zn) deficiency, and/or soil compaction. Similarly, four single and two double crosses were made for combining resistance to Bean common mosaic virus (BCMV), common bacterial blight (CBB), and rust. Temperate North American and tropical parental germplasm used in these crosses were selected in stressed and non-stressed conditions between 1999 and 2001. Soil Zn deficiency susceptible small black (T 39) and resistant great northern (Matterhorn) parents, their F1, F2, and respective backcrosses were evaluated in a Zn deficient field at Kimberly, Idaho. Resistance to Zn deficiency was dominant in F1. A single gene segregation was recorded in F2 that was supported by lack of segregation in the backcross to the resistant, and 1 resistant: 1 susceptible segregation in the backcross to the susceptible parent. Among several dozen temperate, tropical, and subtropical germplasm screened for reaction to root knot nematodes (*Meloidogyne chitwoodi* and *M. hapla*) Brazilian cultivar Carioca and its derived 'Apore' and A 252 had moderate to high resistance. None of the US cultivars from various small-, medium-, and large-seeded classes were resistant. The 51st Cooperative Dry Bean Nursery was organized and distributed to 23 collaborators in the US and Canada. The 40 entries, including standard checks representing different market classes, were evaluated for seed yield, maturity, plant type, canning quality, and reaction to important diseases. The second Western Regional Bean Trial with 32 entries was organized and distributed to participants in Colorado, Maryland, and Washington.

Impact:

A dominant gene for bean resistance to Zn deficiency/dependency was identified. Incorporation of this gene into commercial bean cultivars will lower the need to supply Zn to the crop and, thus lower input costs.

Project Number: IDA01216**CRIS Number:** 0188548**Goal:** 1**Program:** 1**RPA:** 213**ENVIRONMENTAL FATE OF BIOPESTICIDES AND HERBICIDES IN IDAHO POTATO CROPPING SYSTEMS****Investigators:** Hutchinson, P. J.**Termination Date:** 06/30/2006**Reporting period:** 01/01/2001 to 12/31/2001**Progress Report:**

Imazamox environmental fate: Imazamox at 0, 0.04, or 0.08 lb ai/A (0, 1X, 2X) was applied to

Clearfield winter wheat fall 1999, and spring 2000 near Aberdeen, ID. Treatments of fall 1999 applied 1X and 2X rates with a simulated winter kill (glyphosate application spring 2000) and plant-back to non-Clearfield wheat spring 2000 were included in the trial. Clearfield and winter-kill non-Clearfield plots were harvested fall 2000. Non-Clearfield winter wheat planted fall 2000 had no crop response or yield loss in imazamox treated plots compared to the untreated control. While spring barley planted in 2001 was stunted in the 2X spring 2000 plots, yields were not reduced. Although there was a trend for lower U.S. No. 1 tuber yields in simulated winter-kill plots, potatoes planted in the trial area in 2001 were not significantly affected. Overall % visual injury ranged from 24 to 56% for sugar beets planted spring 2001. Only the fall 1999 1X rate with simulated winter-kill resulted in reduced sugar beet yield. Soil samples were collected immediately before and after applications in 1999 and 2000, and periodically during the 2000 and 2001 growing seasons. Imazamox degradation will be determined. Potato and sugar beet will be planted in the trial area again in 2002. A second trial was initiated in Clearfield spring wheat spring 2001. Imazamox at 0, 0.032, 0.04, 0.064, or 0.08 lb ai/A was applied spring 2001. Potato and sugar beet will be planted in the trial area spring 2002. Follow-crop response during the growing season, and at harvest time will be assessed. Soil samples collected at application time, periodically during 2001, and to be collected during the 2002 follow-crop growing season, will be analyzed for imazamox concentration and degradation determination. Sulfentrazone environmental fate: Sulfentrazone applied preemergence to potato in 2000 at 1X (0.094 lb ai/A), or 2X rates (0.188 lb ai/A), resulted in no visual injury, or yield reduction of sugar beets planted 1 year later in a trial near Aberdeen, ID. Sulfentrazone will be applied to potato at 0, 1X, 2X rates spring 2002. Winter wheat and Brassica napus will be planted in the trial area fall 2002, and barley and sugar beet will be planted spring 2003. Follow-crop response during the 2003 growing season and at harvest time will be determined. Soil samples will be collected immediately before and after spring 2002 application, and periodically during the 2002 and 2003 growing seasons for sulfentrazone degradation determination. Potato crop response to brassica green manures and biofumigant compound degradation: A Brassica green manure field trial will be initiated fall 2002. Green manure treatments will be soil-incorporated spring 2003. Soil samples will be collected periodically after green manure incorporation to determine glucosinolate content and degradation determination. Potatoes will be planted 0, 3, 7, 14, and 21 days after green manure incorporation to determine appropriate planting-after-incorporation time. A potato variety tolerance trial will be initiated spring 2003 to determine varietal response to brassica green manure incorporated just prior to potato planting.

Impact:

Imazamox and sulfentrazone follow-crop trial results will be used to determine plant-back restrictions and recommendations. Based on southeast Idaho trial results, these restrictions and recommendations may be different for the Pacific Northwest than what has been determined for these herbicides in other potato production areas. Determination of biofumigant compound degradation, and effects on potato planting timing and crop safety, will assist in developing best management practices for brassica green manures in potato cropping systems.

Project Number: IDA01217

CRIS Number: 0188559

Goal: 1

Program: 1

RPA: 205

YIELD IMPROVEMENTS OF SPANISH SWEET ONIONS GROWN FROM PRIMED SEED OR FROM METALAXYL TREATMENTS AT PLANTING

Investigators: Geary, B. D.

Termination Date: 06/30/2006

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

According to a soil analysis, populations of Pythium within the soil were moderate before onions were planted. Environmental conditions in the early spring when the first group of onions were planted were considered favorable for Pythium and some damping-off was anticipated. However, there were no significant differences between the untreated and treated onions in the plots that were planted early and irrigated according to standard commercial practices. In most cases, the untreated plots tended to have the highest stand counts and yields. Stand counts were down considerably from the previous year, but it was determined that low stands were due to soil tillage during poor environmental conditions that resulted in soil compaction and eventually poor seedling emergence. The early-planted onions for all three cultivars (red 'Flare', white 'Sterling', and yellow 'Vega') were planted and grown according to local commercial practices. Effects of Ridomil from the 2000 growing season, when Pythium populations were favored by extra water (onions planted later due to water availability), indicated that Ridomil would increase stands and yield. Therefore, it was necessary to test Ridomil under standard growing conditions. Ridomil was again tested on late onions under conditions of extra water to determine if the product was effective two years in a row. Similar to the 2000 growing season, granular formulations of Ridomil on cultivar 'Vega' yellow onions significantly increased stands and yield. The 2001 growing season was the first year to study Ridomil on white and red onions under extra water applied by solid set pipes, and there were no differences between treated and untreated plots. Data from all early planted onions and from the white and red onions planted later and sprinkler irrigated would indicate that Ridomil applications at planting are not worthwhile. However, this is data from one year's research and the results must be validated with data from at least one more year. Data, from two years of research on yellow cultivar 'Vega' onions, indicates that when planted approximately 4 weeks behind normal planting dates and watered with solid set pipes for the first 6 weeks, granular Ridomil at label rates is beneficial to onion stands and yields. Primed onion seed of the cultivars 'Caballero' and 'Vision' initially started with higher emergence rates than unprimed seed. Following eight weeks of stand counts, there were no differences between the primed and unprimed seed of the cultivar 'Caballero'. When stand counts were averaged over the eight-week period for the cultivar 'Vision' the unprimed seed was better. After harvest, yields were better with the primed seed than with the unprimed seed, regardless of cultivars.

Impact:

Onion growers in the Treasure Valley of Idaho and Eastern Oregon apply Mefenoxam to onions at planting time to control pythium damping-off. This study will determine if these applications are an economical form of disease suppression. It will also determine if primed onion seed is better at establishing stands and producing better yields.

Project Number: IDA01221

CRIS Number: 0189058

Goal: 1

Program: 1

RPA: 204

POTATO VARIETY IMPROVEMENT, EVALUATION, MANAGEMENT, AND SEED INCREASES IN IDAHO

Investigators: Love, S. L.

Termination Date: 06/30/2006

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Two new varieties, Alturas and Ivory Crisp, were released. Alturas is a high yielding, high solids potato developed specifically to supply supplemental raw product for the dehydration industry. It is projected that 10,000 acres will be produced in 2002. Ivory Crisp is the first cold chipper to be released that is adapted to Northwest growing conditions. It has the ability to provide high quality chip stock from long term storage, a rarity among chippers. It is being used for chip production in southern Idaho and has also been accepted by a significant number of growers in North Dakota and Minnesota. In 2001, over 190 potato clones were evaluated in 30 trials at six sites located across southern Idaho. These trials included evaluations of yield, tuber quality, processing performance, storability, disease resistance, and response to agronomic inputs. Continued efforts were made to identify resistance to corky ringspot in germplasm with processing quality. It was discovered that the late blight resistant clone A90586-11 has a relatively high level of resistance to this disease. Characterization of resistance in three segregating populations was initiated as the first step in identifying selectable markers. A graduate student was recruited to continue this project. A project was initiated in 1999 to improve the vitamin C content of the Northwest breeding germplasm base. Clones with high levels of vitamin C were crossed in the green house in the spring of 2001. True seed is being prepared for grow out and evaluation, representing the first cycle of recurrent selection. High vitamin C x low vitamin C crosses were also made and will be used for determination of the inheritance of vitamin C in potato. It was determined that the viscoanalyzer can detect differences in starch characteristics among varieties with a range of processing quality. In 2001, storage research was conducted to determine if this instrument can be used to detect changes in quality that occur during storage. Initial sensory evaluations were completed and it was found that there is a strong correlation between the viscoanalyzer values and preference for cooked products. Additional research time was put into management studies for new varieties and the management x variety interactions that result, including studies on planting

depth, hilling practices, plant population, herbicide response, and fertility. An extensive nitrogen study was completed in 2001, documenting nitrogen effects on dry matter partitioning, yield, and quality of some to the new varieties. The study showed Bannock Russet and A84118-3 each have a high degree of nitrogen use efficiency.

Impact: This research is one component of the Tri-state potato variety development project. This project has had a positive multi-million dollar impact on the Northwest potato industry through the release of varieties with improved yield, disease resistance, production efficiency, and tuber quality. Given that the germplasm that forms the basis for this research continues to improve, the economic impact of imminent variety releases will have a similar positive impact.

Project Number: IDA01222

CRIS Number: 0189717

Goal: 1

Program: 1

RPA: 201

DEVELOPMENT OF IMPROVED WHEAT CULTIVARS FOR IDAHO

Investigators: Souza, E. J.

Termination Date: 06/30/2006

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

This year we proposed for release the hard red winter wheat DW (IDO513) and the hard white winter wheat Gary (IDO550). Both winter wheats are targeted at rain-fed production in southeastern Idaho. IDO526 SWS is a candidate for release in the next year and was placed in US Wheat's Asian Products Collaborative (APC) for a second year. Last year's APC evaluation found that IDO526 made excellent low protein noodles and steam breads and improved the performance of most hard white wheats in blends to make intermediate protein noodle flours. We are proposing for release in the next year an irrigated hard red winter wheat for utilization by the domestic milling industry. IDO517 is similar in yield to Stephens but less than Boundary hard red winter wheat. IDO517 does represent a significant improvement over Boundary with reduced lodging, shorter plant height, greater protein content, and quality.

Impact:

The efforts of this breeding program are providing growers with a steady stream of new cultivars. The goals of improving quality, decreased production costs, and improved yields will keep Idaho growers competitive in the world marketplace.

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Project Number: IDA01204

CRIS Number: 0189425

Goal: 1

Program: 1

RPA: 213

SHEEP GRAZING FOR NOXIOUS RANGELAND WEED MANAGEMENT IN IDAHO

Investigators: Launchbaugh, K. L.

Termination Date: 06/30/2006

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Initial research on the forage value of weeds and grazing effects supports the idea that sheep may be an important component of integrated weed management programs. In examinations of spotted knapweed (*Centaurea maculosa*), it is clear that knapweed is a viable forage for ruminant livestock (35-58% fiber and 43-70% digestibility). Related studies revealed that sheep readily graze knapweed often in preference to perennial grass. In a set of studies where grazing was simulated by clipping, we found that defoliation of knapweed or surrounding plants had no effect on basal cover of knapweed or associated perennial grasses. However, clipping treatments resulted in greater death rates of defoliated knapweed plants than unclipped plants. Clipping also strongly reduced the number of flowers produced per plot and these clipping effects were observed regardless of season. The line of research initiated with spotted knapweed will be extended to yellow starthistle (*Centaurea solstitialis*) and rush skeletonweed (*Chondrilla juncea*) in the 2002 field season.

Impact:

This research has demonstrated that sheep are a viable weed control technique for many rangeland weeds and has fueled much interest and the use of sheep grazing in integrated weed management strategies.

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Project Number: IDA01105

CRIS Number: 0172432

Goal: 1

Program: 1

RPA: 203

SALICYLIC ACID IN POTATO DISEASE RESISTANCE

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Investigators: Chen, Z.

Termination Date: 06/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report: We have been studying the molecular mechanisms by which plant defense signal molecule salicylic acid (SA) induces defense response in various plants including potato, tobacco and Arabidopsis. During the last year, we have been studying a group of WRKY transcription factors that are induced by SA and pathogen infection. We have demonstrated that these WRKY transcription factors regulate expression of genes closely associated with plant defense response. In addition, we have recently identified a SA-inducible RNA-dependent RNA polymerase (RdRP) with an important role in plant antiviral defense. Transgenic plants expressing antisense RNA for the RdRP gene are more susceptible to a number of plant viruses.

Impact:

Identification and analysis of regulatory components important for SA-induced plant defense response will help understand how plants respond to pathogen infection and defend themselves upon microbial pathogen infection. The knowledge will help develop novel strategies to improve disease resistance traits of crop plants.



Project Number: IDA01158

CRIS Number: 0181340

Goal: 1

Program: 1

RPA: 201

A CHAPERONE CONTROLLING MOTILITY AND DEVELOPMENT OF MYXOCOCCUS XANTHUS

Investigators: Hartzell, P. L.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

In addition to our previous finding that a HSP70 chaperone is required for S-motility and development, we now know that the primary regulator, MglA (a Ras-like GTPase) interacts with a golgin-like protein, AglZ, to control A motility. The yeast two-hybrid system was used to identify genes encoding proteins that interact with MglA. Plasmid pGBT-MglA was used as bait against the M xanthus pGAD-library in host strain PJ69-4A. We recovered derivatives of pGAD with M. xanthus inserts that permit growth of strain PJ69-4A on His-Ade drop-out medium and produce high levels of beta-galactosidase with pGBT-MglA, but not with control plasmid pGBT. One of

the positive yeast transformants contained part of an *M. xanthus* gene, which we named *aglZ*, encoding a protein that has multiple high scoring coiled-coil regions. When a fragment internal to the *aglZ* gene was introduced into *M. xanthus*, homologous recombination gave rise to Kan resistant colonies that lacked A-motility. When this disruption was transduced into a *M. xanthus* S-motility mutant, the resulting double mutant (A-S-) was non-motile. In contrast, when transduced into an A-gliding mutant, the double mutant (A-A-) had motility like that of the parent. This result shows that *aglZ* is part of the A motility system. During the construction of these double mutants, we discovered that this new A-motility gene is linked closely with a group of A-motility genes, specifically *AglU* encoding homologs of the *E. coli* Tol proteins. The close proximity of the *aglU* and *aglZ* genes may indicate a common function. . The N-terminal domain of *AglZ* shares identity with *FrzS* and a large family of response regulator proteins which are targets for phosphorylation at a conserved Asp residue. Like *FrzS*, the C-terminal domain of *AglZ* scores well with programs designed to predict coiled coils. Hence, we predict that *AglZ* is a coiled-coil protein. In the case of *FrzS*, the predictions are accurate - *FrzS* protein forms a highly regular repeating pattern within *E. coli* cells. The C-terminus of *AglZ* also resembles eukaryotic coiled coil proteins such as myosin, SNAD, and ZipA. *AglZ* shares 25% identity and 46% similarity over 300 residues with both mammalian golgin and *Emericella nidulans* SNAD. In *E. nidulans*, mutations in SNAD are isolated as suppressors of mutations in *NudA1*, which encodes dynein. *AglZ* shares 22% identity and 49% similarity with ZipA from *Dictyostelium*. ZipA (leucine zipper-like domains) is related to integrin and interaptin, an actin-binding protein of the alpha-actinin superfamily in *D. discoideum*. ZIPA is a developmentally and cAMP-regulated protein that associates with intracellular membrane compartments. *AglZ* is also similar to golgins, such as Rab kinesin-6, which interact with small GTPases and are thought to act as tethers in the Golgi. Taken together, these data hint that *MglA* interacts with a structural component of the A-gliding motor. This motor may resemble a precursor for eukaryotic actin/myosin or tubulin/dynein motors.

Impact:

The results of these studies pave the way for understanding the mechanism by which many antibiotic-producing and nutrient-cycling bacteria move through soil systems.

Project Number: IDA01090

CRIS Number: 0168035

Goal: 1

Program: 1

RPA: 212

MOLECULAR GENETICS OF FUNGAL REPRODUCTION

Investigators: Miller, B. L.

Start Date: 07/01/1995 **Termination Date:** 06/30/2001

Reporting period: 07/01/1995 to 06/30/2001

Termination Report:

Environmental or intrinsic factors activate diverse signal transduction pathways that initiate genetic regulatory pathways that result in multicellular development of fungal reproductive and/or infection structures. In the filamentous fungus *Aspergillus nidulans*, internal and external signals that include light, oxidative metabolism and nutritional factors induce two highly synchronous developmental events: asexual reproduction (conidiation) and sexual reproduction. The former leads to formation of aerially dispersed conidia, or spores while the latter leads to structures that enclose highly stable sexual spores that can survive for long periods in the environment. We investigated the fundamental biological processes and the genes that control development in *A. nidulans*. This work included structure/function analysis of the founding member of a family of fungal developmental proteins, Stunted (StuA), that coordinates development-specific and cell cycle-specific gene expression. DopA is the founding member of a novel protein family required for correct cell morphology and spatiotemporal organization of multicellular structures in the filamentous fungus *A. nidulans*. We also identified and characterized the dopey (*dopA*) gene from *A. nidulans*. DopA homologs from *Saccharomyces cerevisiae* (Dop1), *Candida albicans*, *Caenorhabditis elegans*, *Rattus norvegicus* and *Homo sapiens* have been identified from genome sequencing projects. *S. cerevisiae* DOP1 is essential for viability and, like DopA, affects cellular morphogenesis. Asexual reproduction is delayed and asynchronous in strains with the temperature sensitive *dopA1ts* allele. Conidiophore morphogenesis is aberrant and there is an early block in the sexual cycle. DopA functions upstream in the developmental pathway, down-regulating signal transduction through the small G protein, Ras, to modulate hyphal morphogenesis and asexual development. We have also isolated and characterized the *A. nidulans* *sterileA* (*steA*) gene, the first STE12-related gene from a true filamentous fungus. The *S. cerevisiae* Ste12p protein plays a key role in coupling signal transduction through MAP kinase modules to cell-specific or morphogenesis-specific gene expression required for mating and pseudohyphal (PH)/filamentous growth (FG). Ste12p homologs in the human pathogenic yeasts *C. albicans* and *F. neoformans* apparently play similar roles during dimorphic transitions. A *DsteA* strain is sterile and differentiates neither ascogenous tissue nor fruiting bodies (cleistothecia). Filamentous growth, conidiation and the differentiation of PH-like asexual reproductive cells (metulae and phialides) are normal in the deletion strain. Northern analysis of key regulators of the asexual and sexual reproductive cycles support the observation that although SteAp function is restricted to the sexual cycle, cross regulation between the two developmental pathways exists. Our results further suggest that while several classes of related proteins control similar morphogenetic events in *A. nidulans* and the dimorphic yeasts, significant differences must exist in the regulatory circuitry.

Impact:

Aspergillus nidulans has long been used as a model for genetic and developmental studies of filamentous fungi. *A. nidulans* is closely related to both industrially important fungi as well as those that are important plant and animal pathogens. This work has provided a wealth of knowledge for industrially important metabolic pathways, for health-related metabolic pathways such as aflatoxin biosynthesis and for development of pharmaceuticals. Our work, together with that of others in the field provides important insights into fundamental processes

controlling development in fungi as well as higher organisms. In this report we have identified the novel DopA family of proteins that control morphogenesis and development in fungi as well as lower animals and possibly humans. The work with SteA has allowed us to begin to integrate signal transduction pathways with the extensive information for developmental gene regulation in *A. nidulans*.

Allocated Resources IAES Program 1:

RPA	SY	PY/TY	Amount
201	0.8	0.86	\$828,086
202	1.146	2	\$289,974
203	2.06	2	\$420,093
204	3.65	3.7068	\$927,771
205	0.88	0.3	\$256,435
206	0	0	\$13,914
211	4.1846	6.8615	\$924,323
212	6.837	2.3875	\$850,221
213	3.45	0.78	\$1,006,340
214	1	0	\$95,246
Total	24.01	18.90	\$5,612,403

IAES Program 2 : Animal Health and Well-Being (RPAs 301, 302, 305, 307, 311, 312, 313, 315)

Performance goals:

Improved detection, control and treatment of infectious diseases of domestic animals in the Northwest and United States. Livestock and dairy product quality and consistency will be monitored and maintained for the benefit of consumers.

Progress/Impacts:

Project Number: IDA01123
CRIS Number: 0174948
Multi-State Project: W-112

Goal: 1
Program: 2
RPA: 301

REPRODUCTIVE PERFORMANCE IN DOMESTIC RUMINANTS

Investigators: Ward, A. C.

Termination Date: 09/30/2001

Reporting period: 10/01/1996 to 09/30/2001

Termination Report:

Primary objectives of the research were to characterize members of Pasteurellaceae for markers associated with host and tissue predilection, virulence and disease association. More than 5,000 Pasteurellaceae isolates were characterized and preserved. Over 4,000 of the isolates are from wild sheep sampled in Alaska, Canada and 13 of the western lower continental United States. Additional isolates are from American bison, other native American wild ruminants, and domestic livestock. Biochemical utilization tests were used to differentiate isolates of *Pasteurella haemolytica*, *P. multocida*, *P. trehalosi* and *Haemophilus somnus* into more than 80 biovariants. This procedure demonstrated geographic distributions and apparent host predilections of many biovariant groups. Variances in electrophoretic restriction fragment length polymorphism (RFLP) of DNA from isolates within individual biovariant groups following reaction with restriction endonucleases was used to further differentiate strains. Polymerase chain reactions (PCR) were also used to distinguish between isolates based on the presence of genes associated with virulence including the *lktA* gene essential for leukotoxin production in *P. haemolytica* and *P. trehalosi*, the *toxA* gene responsible for production of dermonecrototoxin by *P. multocida* strains and the *sodC* gene responsible for superoxide dismutase production which disarms a component of the killing capacity of host phagocytic cells by some *Pasteurella* spp and *H. somnus* isolates. Analyses of positive PCR *lktA*, *toxA* and *sodC* gene products also revealed variances in the internal structures of the products which may be associated with differences in virulence and host susceptibility. Our knowledge regarding distribution of these organisms has been expanded as a result of this work, including the first detection of *H. somnus* from bison and bighorn sheep.

Impact:

Knowledge of the distribution and diversity of Pasteurellaceae isolates from wild and domestic animals was greatly expanded. This information provides a basis for prediction of disease potentials for individual Pasteurellaceae strains.

Project Number: IDA01095

CRIS Number: 0171687

Goal: 1
Program: 2
RPA: 301

RELAXATION OF ISTHMIC CIRCULAR SMOOTH MUSCLE: PROPOSED MECHANISM BY WHICH PGE2 OF EMBRYO ORIGIN

Investigators: Woods, G. L.

Termination Date: 06/30/2002 **Reporting period:** 01/01/2001 to 12/31/2001

Progress Report:

Nuclear transfer (NT) has been used to produce cloned offspring from sheep, cattle, goats, pigs and mice; however, the production of cloned offspring of an equine species has not been reported. Nuclear transfer is performed by fusing a nuclear donor cell with an enucleated metaphase II (MII) oocyte. The resulting NT embryo uses the donor cell DNA as the template for subsequent gene expression, which results in a genetically identical clone of the donor cell line. Nuclear transfer research has increased our understanding of basic aspects of oocyte physiology and cell biology (e.g., gene expression), and has potential for practical application in production animal agriculture and for the preservation of endangered species. For the equine industry, NT is one of several new assisted reproductive techniques (e.g., oocyte transfer, intra-cytoplasmic sperm injection) being developed for clinical use. The objective of this study was to use NT to clone a mule, a sterile equine hybrid.

Impact:

Seven of 195 (3.6%) cloned mule embryos resulted in pregnancies detected with transrectal ultrasonography. An embryo-proper with a heartbeat was detected in one conceptus. Each pregnancy was spontaneously eliminated between Days 27 and 61 of gestation.

Project Number: IDA01127

CRIS Number: 0183667

Goal: 1

Program: 2

RPA: 307

MANAGEMENT, IMPACT AND ECONOMICS OF BEEF CATTLE GRAZING IN THE PACIFIC NORTHWEST

Investigators: Momont, P. A.

Termination Date: 06/30/2002

Reporting period: 07/01/1997 to 06/30/2002

Termination Report:

Implementation of early summer grazing of riparian areas into a grazing management system has proven to be very effective in altering the duration, distribution and vegetation utilization patterns of cattle grazing a riparian area and its adjacent uplands along the foothills of the Wallowa Mountains. During early summer, when forage quantity and composition are not limiting and ambient air temperatures are low, livestock distribution patterns are more evenly distributed and vegetation utilization patterns are more uniform. During late summer, ambient air temperatures increase, forage DM increases, livestock distance from the stream decreases and fecal deposits within 1 m of the stream increase. These factors, in turn, may lead to increased riparian area vegetation utilization and woody browse, and increased bank trampling. As long as early use does not cause problems due to wet saturated soils, early summer grazing of riparian areas reduced the impacts from cattle on these habitats.

Impact:

Managers may make better management decisions using factors like off-stream water sources, herding of cattle during the heat of the day, and providing alternative shade sources for cattle during the late summer grazing period. These actions may achieve more uniform cattle distribution and vegetation utilization patterns.

Project Number: IDA01145

CRIS Number: 0178039

Goal: 1

Program: 2

RPA: 311

STUDY OF TRANSMISSION AND EARLY DETECTION OF SCRAPIE

Investigators: Bulgin, M. S.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

This year's lambing resulted in 58 surviving scrapie-exposed lambs. Genotyping has not yet been completed on all of the last 2 crops of lambs since we have been having trouble with our test. Thus, we have over 100 scrapie-exposed animals in this flock of which 30 will have to be removed after genotyping results are obtained. Four animals were clinically positive and died of scrapie since December of last year. That is opposed to 10 animals the year before. The decrease in numbers affected with scrapie is a reflection on the number of animals at risk. The average age of disease onset is between 3-3.5 years of age. We only had 13, 3-4 year-old genotypic susceptible animals. However, there are 25 1999-born animals at risk for next year. The blood and part of the brains of these 4 animals were made available to our collaborator, Dr. Rohwer of Baltimore Research and Education Foundation for his work on a live animal/person diagnostic test for scrapie and related transmissible spongiform encephalopathies, specifically Creutzfeldt-Jakob Disease of humans. A blind panel validation test was devised for Dr. Mary Jo Schmerr's capillary

electrophoresis test. Twelve tubes of blood taken from each of 15 sheep were given random numbers by a third party and sent to Dr. Schmerr on 3 different occasions. The results of the last test looked promising.

Impact:

If a blood test can be perfected, the impact would be an economic boon to the sheep and cattle industry. A test and slaughter program would ensure the eradication of scrapie. It would be also be used to guarantee the safety of the human blood and food supply.

Project Number: IDA01176

CRIS Number: 0182436

Multi-State Project: W-112

Goal: 1

Program: 2

RPA: 301

REPRODUCTIVE PERFORMANCE IN DOMESTIC RUMINANTS

Investigators: Ott, T. L.

Termination Date: 09/30/2001

Reporting period: 07/01/1999 to 09/30/2001

Termination Report:

The majority of early embryonic loss occurs during the peri-implantation period. To reduce the incidence of early embryonic mortality we must have a better understanding of the biochemical communication between the peri-implantation conceptus and the uterine endometrium. We obtained cell lines recently developed from the ovine uterus to use as in vitro models for the ovine uterus. These four cell lines were developed from ovine luminal (LE) and glandular (GE) epithelium, stroma (ST) and myometrium (MYO). We validated the culture system for the cell lines and established their morphology and growth (DNA and Protein) characteristics over time. The GE cells are responsive to recombinant ovine interferon tau (IFN tau) as steady-state levels of mRNA for the antiviral protein Mx are elevated in response to as little as 1 unit of IFN tau. Mx mRNA levels are elevated at 3 hours, are maximal between 6 and 12 hours, and remain elevated at 96 hours of continuous exposure to IFN tau. This increase in Mx mRNA levels is accompanied by an increase in Mx protein levels within 6 hour of IFN tau treatment. Experiments examining the regulation and function of the Mx gene in vitro are ongoing. To aid in the assay of Mx protein, two polyclonal anti-peptide ovine Mx antisera were commercially prepared. One antiserum is directed at the amino terminus and the other at the carboxyl terminus of oMx. Both antisera are of high titer and recognize native ovine IFN tau and recombinant human MxA following 1D-SDS PAGE and Western blotting. These antisera are currently being used to develop a sandwich ELISA to measure Mx in cell lysates and whole blood. To address whether the high levels of IFN

tau in the uterus during early pregnancy affect Mx gene expression in the peripheral blood mononuclear cells (PBMC), PBMCs were isolated from 150 ewes 26 days post AI. Total cellular RNA was extracted and assayed for steady-state levels of Mx mRNA. Mx gene expression was increased in PBMC from pregnant ewes 26 days post-AI compared to cyclic ewes. Level of Mx mRNA was correlated with number of lambs born per ewe. To examine regulation of the uterine Mx gene, an ovine genomic library with 2 X genomic coverage was screened with Mx primers overlapping intron/exon boundaries at exon 3. A superpool, pool and then individual Mx clone was isolated following successive rounds of screening. This cloned was hydrosheared and sub-cloned as 5-8 kb fragments clones prepared from this "shot-gun" library were spotted on nylon membranes and screened with a oMx exon 1 cDNA. Forty six positive clones were identified and these clones are currently be mapped in preparation for sequencing and identification of the oMx promoter/enhancer region.

Impact:

Early embryonic mortality results in over a billion dollars annual loss to animal agriculture. This project examines the biochemical communication between the early embryo and the uterine endometrium and should lead to management tools/strategies to reduce embryonic mortality in domestic farm animals.

Project Number: IDA01177

CRIS Number: 0182437

Goal: 1

Program: 2

RPA: 302

REGULATION OF THE DIGESTION KINETICS OF PROCESSED CEREAL GRAINS

Investigators: Hinman, D. D., Sorensen, S. J.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Barley is commonly used as the grain in high-energy feedlot diets, but has the drawback of digesting too rapidly when processed causing digestive problems. The protein matrix in corn causes the starch in corn to digest more slowly than barley starch. A method to reduce the ruminal starch digestion rate would improve the feeding characteristics of barley by reducing the incidence of ruminal dysfunction associated with high levels of barley. Gallatin barley was treated three different ways and compared to dry rolled corn (DRC). Barley was either dry rolled (DRB), or roasted at 177C for 5 minutes and rolled through a standard rolling mill while hot (DRR), or tempered at 20% moisture for 24 h, then roasted at 177C for 5 min and rolled while hot (TRR). Four ruminally cannulated steers were used in a 4 x 4 factorial in situ study. Nylon bags containing the treatments were incubated in the rumen for 0, 1, 2, 4, 6, 8, 12, 24, and 48 h. Amounts of DM, CP, ADF, ADIN, and starch were measured in the residue to determine extent

and rate of disappearance. Roasting the barley increased the amount of ADIN from .04% to .13%, and roasting in the presence of free water increased the amount of ADIN found in the TRR treatment to .22%. Extent of DM remaining was not different ($P > .10$) at 48 h between treatments. Rate of DM disappearance was greatest ($P < .10$) for TRR in the first 6 h of incubation as well as for the entire 48 h period. Rate of CP disappearance was faster ($P < .10$) for DRB than the other treatments for the first 6 h of incubation. Tempered roasted rolled barley had a faster ($P < .10$) 48 h CP disappearance rate than DRR, though the amount of CP remaining at 48 h was similar ($P > .10$) for all treatments. The amount of starch remaining was greater ($P < .10$) for DRC at all hours until 48 h when the amounts of starch remaining were similar ($P > .10$) among treatments. During the first 6 h of incubation the starch disappearance rate was most rapid ($P < .10$) for TRR. The starch disappearance rate for the entire 48 h incubation period was greater ($P < .10$) for DRC than DRB while being similar ($P > .10$) to DRR and TRR. Extent of starch disappearance at 48 h was similar ($P > .10$) for all treatments. The results of this study indicate that dry roasting then rolling Gallatin barley decreases the rate of ruminal digestion.

Impact:

The results of this study indicate that dry roasting then rolling barley reduces the rate of ruminal digestion more than tempering roasting rolling barley (which actually enhanced early starch disappearance rate) to a rate similar to dry rolled corn. Dry roasting and rolling barley grain without tempering reduces the amount of energy and equipment costs associated with grain processing.

Project Number: IDA01178

CRIS Number: 0182438

Goal: 1

Program: 2

RPA: 302

STRATEGIES FOR OPTIMIZING THE UTILIZATION OF ENERGY RESOURCES BY DOMESTIC RUMINANT ANIMALS

Investigators: Hunt, C. W.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Environmental regulations restrict burning of grass seed residue which has created interest in improving the nutritional value of these residues for livestock. Eighteen bales of bluegrass seed straw (average 227 kg) were obtained to evaluate the effect of 0 (A0), 3 (A3) and 5 (A5) percent ammoniation on nutrient composition and ruminal degradability. Four ruminally cannulated mature beef steers were used in a 4 x 4 Latin square design to determine the effects of ammoniation or added DIP (urea) on digestion of bluegrass straw. Dietary treatments were A0, A3, A5, and A0 plus supplemental DIP. In situ DM and NDF degradabilities were greater ($P <$

0.05) for A5 than other treatments ($P < 0.10$) at 24, 36, 48, and 96 h of ruminal incubation. Similarly, total tract DM, OM, NDF, and ADF digestibility was greater ($P < 0.05$) for A5 compared to all other dietary treatments. Differences in DM and OM digestibility were not observed between the other treatments. Ammoniation of grass seed straw at the 5% level enhanced digestibility more than the 3% level. Supplemental DIP increased ruminal ammonia but was not effective in increasing digestibility. A study is in progress to examine increased moisture level and reduced bale density as a means to gain the same advantage from 3% as 5% ammoniation. Other laboratory-based in vitro experiments were conducted to identify sources of fungal-extracted enzymes that would enhance the ruminal degradability of grass seed straw. Eight enzymes from 3 commercial sources were screened by in vitro procedures using a batch incubator and 3 were selected. A total of 4 in vitro experiments were conducted investigating the effect of source and level of enzyme, application procedures, and level of grain included with the incubated straw. In vitro DM degradability was greater for 5% ammoniated straw than untreated bluegrass straw; however, in vitro degradability of bluegrass straw was not consistently improved by the application of commercial fibrolytic enzymes. Enzymes did not improve in vitro degradability of bluegrass straw beyond that achieved through ammoniation. Most recently we evaluated an enzyme preparation that was shown to have fibrolytic activity when incubated with barley. Samples of untreated and ammoniated (5 percent ammonia) grass seed straw were untreated or treated with the enzyme preparation. Samples were incubated in for 24 hours in two cannulated cows. The enzyme preparation dramatically increased DM, NDF, and ADF degradability of both control and ammoniated bluegrass straw. A current study investigates the in vivo responses to ammoniation and addition of this enzyme.

Impact:

Field burning of grass seed crop aftermath is important for sustained seed production, however this practice is a serious air quality hazard. Our studies identify economic viable alternatives to removal of the crop aftermath via field burning. Ammoniation is a viable method of converting grass seed straw into a feed resource for wintering beef cattle. Future studies will determine if exogenous enzymes can further enhance the benefit of ammoniation.

Project Number: IDA01179

CRIS Number: 0182439

Goal: 1

Program: 2

RPA: 311

BIOLOGY AND CONTROL OF EMERGING DISEASES SHARED BY LIVESTOCK AND WILDLIFE

Investigators: Zaugg, J. L., Bulgin, M. S., Anderson, B. C., England, J. J.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

In an attempt to evaluate the susceptibility of mule deer to experimental infection of Scrapie disease of sheep, four mule deer fawns were obtained and raised in especially constructed facilities. Before the deer could be experimentally infected, they all died from unrelated causes. The project is expected to be conducted this next spring with new fawns.

Impact: None to report.

Project Number: IDA01149

CRIS Number: 0178514

Goal: 1

Program: 2

RPA: 312

PHYSIOLOGY OF INSECT BEHAVIOR

Investigators: Klowden, M. J.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Although male accessory gland substances affect many aspects of female physiology in many species of mosquitoes, we have found that they have no effects on mating or oviposition behavior in anophelines. The trigger that switches the female to a mated behavior pattern in *Anopheles gambiae* appears to be the presence of sperm in the spermatheca. We found that a significant sperm polymorphism exists in the seminal vesicles of male *gambiae* but is absent in other anophelines and aedines, and propose that the sperm polymorphism may in some way be involved in the switchover to mated behavior. A significant change in the cuticular hydrocarbons of the female after mating occurred was also observed, and the role of sperm or male accessory gland substances in this alteration, and the effect of the alteration on mating, are currently being pursued.

Impact:

The genetic manipulation of mosquito vectors to make them refractory to infection requires a thorough knowledge of their mating systems. Our work has shown that the mating system of *Anopheles gambiae*, the most important vector of human malaria, is different than that of other mosquitoes.

Project Number: IDA01194

CRIS Number: 0187222

Goal: 1

Program: 2

RPA: 311

GASTROINTESTINAL DISEASES OF NEWBORN CALVES: SEARCH FOR ADDITIONAL CAUSAL PHENOMENA

Investigators: Anderson, B. C.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

In searching for additional organisms that might cause gastroenteritis in calves were screened for Calicivirus. All samples (6) of colon content from diarrheic calves were negative for the virus. Immunodiagnostic methods were employed to detect Coronavirus in the lower small intestine and large intestine of diarrheic calves. We hypothesized that lesions in the severely diseased abomasums of calves with fatal abomasitis might be caused by Coronavirus. There was no coronavirus in those dramatic abomasal lesions. Nor was the virus in the severely inflamed rumens of calves dead of a combined abomasal/ruminal distension and inflammation syndrome. Extensive microscopy and bacterial culturing of abomasums and rumens have not, thus far, revealed a cause. On the other end of the digestive tract, excellent histopathology on specimens harvested within minutes of euthanasia of ill calves, have shown that in many outbreaks, there is a carpet of coliforms adhered to enterocytes of small intestine villi and colonic enterocytes. The parasitized enterocytes usually are obviously degenerate. It remains then, to more specifically identify these putative pathogens so that control measures can be applied.

Impact:

None to report.

Project Number: IDA01195

CRIS Number: 0185222

Goal: 1

Program: 2

RPA: 302

IMPROVING THE EFFICIENCY OF FEED PROTEIN UTILIZATION IN THE DAIRY COW

Investigators: Hristov, A. N.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Microbial protein (MP) flow to the small intestine is critically important in providing alfa-amino N for milk protein synthesis by the dairy cow. In vitro research has shown a stimulatory effect of amino acid and peptide N on MP synthesis in the rumen; proportions of ammonia N-derived bacterial protein decrease with increasing ruminal protein degradability indicating bacterial preference of preformed amino acids. Some feeding systems have introduced a 'peptide factor' in predicting MP flow from the rumen (Cornell Net Carbohydrate and Protein System). To compare bacterial uptake of different forms of N in the rumen, four sources of 15-N were given as intraruminal pulse doses to dairy cows in a 4 by 4 Latin square experiment. Three 15-N sources were derived from 15-N-casein: protein (PRO, unprocessed casein), amino acids (AA, acid hydrolysis) and peptides (PEP, enzymatic hydrolysis); 15-N-labeled ammonium sulfate (NH₃) was used as a control. The cows (205 average days in milk), fed a 43% forage:57% concentrate diet, were given equal amounts of 15-N from the four N sources. Representative samples (12) of fluid associated- and loosely feed particle-associated ruminal bacteria were collected over a 24-h period and analyzed for 15-N-enrichment. Areas under the 15-N-enrichment curves (AUC) of bacterial N did not differ ($P > 0.05$) among treatments. The shortest time ($P < 0.05$) to peak 15-N-enrichment of the bacterial protein was associated with PEP, 1.65 h, followed by PRO and NH₃ (2.0 and 2.5 h, respectively). AA had the longest ($P < 0.05$) time to peak enrichment (3.1 h). Rate of incorporation of tracer was the highest ($P < 0.05$ vs AA and NH₃ and $P < 0.1$ vs PRO) with PEP (3.58 /h) and was similar among the other treatments, from 2.25 (NH₃) to 2.71 /h (PRO). Peak 15-N concentration in bacterial protein was higher ($P < 0.05$) with NH₃ (0.0151 atom percent excess, APE) compared with AA and PEP (0.0099 and 0.0125 APE, respectively). No differences ($P > 0.05$) between treatments in the rate of tracer disappearance (average of 0.099 /h) or tracer half-life in bacterial N were detected. Under the conditions of this experiment, the extents to which N from ammonia, amino acids, peptides and protein were incorporated by ruminal bacteria were not substantially different, but N from PEP was incorporated more rapidly.

Impact:

The overall goal of this project is to improve the efficiency of feed nitrogen utilization in dairy cows. The results from the above-described experiment suggest that peptide nitrogen may be incorporated at a faster rate by the ruminal microorganisms. This finding confirms previous in vitro reports and can be used to better formulate diets for dairy cows.

Project Number: IDA01213

CRIS Number: 0186915

Goal: 1

Program: 2

RPA: 301

INCORPORATING ESTRADIOL CYPIONATE INTO THE TIMED ARTIFICIAL INSEMINATION BREEDING PROTOCOL TO IMPROVE PREGNANCY RATES IN CATTLE

Investigators: Ahmadzadeh, A.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Using exogenous gonadotropin releasing hormone (GnRH) and prostaglandin F2a (PGF2a), a timed AI breeding program was developed (OvSynch) in which ovulation was reportedly synchronized in lactating dairy cows (24-32 hr after the second GnRH administration), thereby allowing timed AI of all cows without the need for estrus detection. Although OvSynch is a convenient method to facilitate AI, when compared to other conventional breeding programs, it has yielded lower conception rates in cows. There is evidence that induction of ovulation by GnRH during proestrus, as occurs in OvSynch, impairs ovarian estradiol secretion and shortens subsequent luteal phase in cattle. Therefore, lower fertility following OvSynch may be due to asynchronous timing of the GnRH-induced luteinizing hormone surge prior to estrus coupled with an abnormal decline in estradiol secretion. This experiment evaluated the use of estradiol cypionate (ECP) when incorporated into the conventional timed AI breeding program (OvSynch) on pregnancy rates in beef cows. Specifically the objective was to compare conception rate of cows which were artificially inseminated after the conventional timed artificial insemination (OvSynch) breeding protocol and those artificially inseminated after the modified OvSynch, indicated above. Seventy British cross-bred mature cows, with a normal reproductive health status, were used for this experiment. Between 60 to 80 days after calving all cows received a luteolytic dose of PGF2a (day -14). Two weeks later (day 0), 100 ug GnRH was administered (i.m.) to all cows to cause luteinization or ovulation of a dominant follicle and development of a CL. On day 7 post-GnRH, cows received 25 mg PGF2a (i.m) to induce luteolysis of the developed CL. Forty-eight hours post-PGF2a, all cows were assigned to one of two treatments. Treatment group (35 cows) received GnRH (100 ug) + 0.25 mg estradiol cypionate (ECP; treatment group) and control group (n =35) received GnRH (100 ug) + 1 mL of cottonseed oil. Estrus activity was monitored and twelve hours later all cows were artificially inseminated. Pregnancy status was examined by ultrasonography on day 40 and 70 post- insemination. Incorporation of ECP into the OvSynch protocol tended to increase ($P < 0.15$) pregnancy rate by 15 % compared to the control group. Further, more cows were detected in estrus ($P < 0.05$) in the treatment group compared to the control group. It appears that incorporation of ECP may increase pregnancy rate in beef cattle. However, this experiment needs to be repeated, using more cows, before we draw a definite conclusion. A fifteen percent increase in pregnancy rate, in the in the first week of the breeding season, has the potential to increase profit by \$1,200 in a 100-cow beef herd.

Impact:

The modified protocol may have a major impact on managing reproduction of lactating cows and beef cows and enhancing profitability of dairy and beef producers regardless of the size of the farm.

Project Number: IDA01131

CRIS Number: 0177722

Goal: 1

Program: 2

RPA: 311

THE REGULATION OF BACTERIAL AUTOLYSIS

Investigators: Bayles, K. W.

Termination Date: 06/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Previously a *Staphylococcus aureus* locus that is involved in the regulation of murein hydrolase activity was identified. This locus is comprised of the *lytSR* operon encoding sensor and response regulator proteins (*LytS* and *LytR*, respectively) of the two-component regulatory family of proteins. Subsequent studies revealed the presence of two *LytSR*-Regulated Genes (designated *lrgA* and *lrgB*) located immediately downstream of the *lytSR* operon, although the functions of these genes were not identified. An important aspect of this system involves understanding the functions of the *lrgA* and *lrgB* genes. Interestingly, the deduced *lrgA* gene product contains striking similarities to the bacteriophage holin family of proteins, which have been shown to control lysis during the development and release of bacteriophage particles. Thus, it was proposed that *LrgA* could have a holin-like function, playing an important role in the regulation of murein hydrolase export. Indeed, mutagenesis of the *lrgAB* operon by allele replacement resulted in an increase in extracellular murein hydrolase activity, indicating that the *lrgAB* gene products affect murein hydrolase activity, possibly by functioning as an inhibitor holin. Furthermore, the *lrgAB* mutation also caused increased sensitivity to the killing effects of penicillin. The wild-type phenotype can be restored by supplying the *lrgAB* gene products in trans. A major advance in our research was the identification of an additional operon (designated *emhABC*) that we believe encodes the effector holin of this system. The products of the *emhA* and *emhB* genes share strong sequence similarity with the *lrgA* and *lrgB* gene products, respectively, and the *emhA* gene product (like the *lrgA* gene product) exhibits physical characteristics in common with the holin family of proteins. Studies of an *emhA* mutant indicate that the *emhAB* operon functions in a manner that is diametrically opposed to the *lrgAB* operon. Deletion of *emhA* results in decreased extracellular murein hydrolase activity and sensitivity to penicillin-induced killing, just opposite to that observed with the *lrgAB* mutant. Interestingly, complementation experiments revealed that only the effects of the *emhA* mutation on murein hydrolase activity could be complemented by supplying the *emhA* gene product in trans. Why the decreased sensitivity to penicillin could not be complemented may involve the recent finding that a third gene (designated *emhC* encoding a pyruvate oxidase homologue) is cotranscribed along with *emhAB* on a 3.1 Kb transcript (unpublished data) and therefore the *emhA* mutation likely has a polar effect on its transcription.

Thus, studies are currently underway to examine the potential role of emhC in penicillin-induced killing.

Impact:

This research has led to a greater understanding of the molecular events that regulate murein hydrolase activity in bacteria and to the mechanism of antibiotic-induced killing. It also provides a basis for the understanding of bacterial programmed cell death, a process that is just beginning to be recognized and understood.

Project Number: IDA01132

CRIS Number: 0177227

Goal: 1

Program: 2

RPA: 311

VIRULENCE GENE MODULATION IN YERSINIA ENTEROCOLITICA

Investigators: Minnich, S. A.

Termination Date: 06/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Our basic goal is to understand temperature regulation in pathogenic bacteria. Our model is *Yersinia enterocolitica*. Pathogenic *Yersinia* phase vary numerous phenotypes between 30 and 37 degrees Celcius. Part of this switch includes two type III protein secretion systems. We have determined that this is necessary because secreted proteins from different type III systems can be cross-recognized. We have now extended our studies and shown that a virulence protein, YopM, is recognized and secreted from the flagellar structure, but only in a deletion mutant which has all three flagellin genes removed. We have also extended and found cross-recognition extends to a third type III system (Ysa) regulated by high salt. Thus, the three type III systems are segregated by environmental cues.

Impact:

These results have a broad impact both on animal and plant pathogenesis. Type III systems are common to most Gram Negative bacteria. We have definitively shown that segregation of multiple type III systems is necessary, and most likely explains why flagellar biosynthesis must be regulated in the host.

Project Number: IDA01197

CRIS Number: 0185655

Goal: 1

Program: 2

RPA: 311

IMMUNOSUPPRESSION BY SUPERANTIGENS: ROLE IN BOVINE MASTITIS

Investigators: Bohach, G. A.

Termination Date: 07/01/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

We propose that immunomodulation by staphylococci predisposed the bovine to mastitis. The mechanisms responsible for initiation and persistence of this illness are unknown. It is hypothesized that superantigens (SAGs), such as staphylococcal enterotoxins (SEs) suppress bovine immunity. Little is known regarding SAG effects in dairy animals. Furthermore, published reports have shown only a low percentage of bacteria from mastitis cases produce SAGs. However, we propose that SAG production is more widespread than initially reported, but that published reports have not assessed strains for novel SAGs. This project contains four objectives which include: 1) To determine the mechanisms by which type C SE (SEC) induces a reversal of the CD4:CD8 T lymphocyte ratio. 2) To characterize purified subpopulations of mononuclear cells in the context of Type 1 and Type 2 immune responses. 3) To characterize the bovine CD8+ACT3+ T lymphocytes induced by SEC. 4) To identify and characterize novel bovine-associated staphylococcal SAGs. To fulfill the first three objectives, we identified the previously uncharacterized cell surface molecule, Activation Molecule 3 (ACT3). This molecule is expressed on a significant percentage of immunosuppressive CD8+ T cells after bovine peripheral blood mononuclear cells are stimulated in vitro with the representative SAG, SEC. Our preliminary data suggested that ACT3 is an indicator of activation of CD8+ T cells by SAGs, and that these cells might be responsible for immunosuppression leading to infection and persistence. The ACT3 molecule was recovered using a monoclonal antibody. This technique produced a large protein (110 kDa) which we identified as the bovine form of CD26, a known multifunctional activation molecule. In other animals, CD26 has several functions including acting as a protease enzyme and also interacting with CD45 and adenosine deaminase, possibly affecting the cow's lymphocyte signaling and function. We cloned and sequenced the bovine CD26 gene and confirmed that the protein was ACT3. For the fourth objective, we have been identifying and characterizing novel staphylococcal SAGs produced by *S. aureus* from bovine mastitis cases. We first checked to determine if the staphylococcal isolates could stimulate bovine lymphocytes as an indicator that they might produce SAGs. Of 209 *S. aureus* isolates from mastitis, 84 stimulated T-lymphocytes. Fifty-seven of the positive strains harbored genes for type G and I SEs. SEG and SEI, only recently identified and found to be highly virulent in humans, were not previously associated with bovine mastitis. Since the discovery of SEA through E decades ago, nine more enterotoxins (SEG through SEO) have been reported recently and more toxins are likely to be identified by this project. These newly identified toxins produced by many bovine isolates support our theory that SAG production in mastitis is more widespread than initially thought.

Impact:

A confirmed role for staphylococcal super antigens in pathogenesis of bovine infectious diseases, particularly those associated with persistent colonization, would be consistent with the inability of traditional approaches to control this significant problem for the animal agriculture industry.

These results may lead to more effective means to control mastitis by allowing a more thorough understanding of the pathogenesis involved. The identification of this immunomodulatory activation marker, plus other prior findings regarding the mixed cytokine response induced by enterotoxin C complements our demonstration of staphylococcal ability to enter and survive in bovine mammary epithelial cells. This property would be expected to promote immune evasion and a lack of effectiveness for conventional vaccines.

Project Number: IDA01199**CRIS Number:** 0185231**Goal:** 1**Program:** 2**RPA:** 311**ANALYSIS OF INTRAFLAGELLAR TRANSPORT AND ITS ROLE IN CILIARY ASSEMBLY IN PLANTS, ANIMALS, AND PROTOZOANS****Investigators:** Cole, D. G.**Termination Date:** 06/30/2005**Reporting period:** 01/01/2001 to 12/31/2001**Progress Report:**

In the past year, we have continued to advance toward completion of our goals in the study of specific components of the intraflagellar transport (IFT) machinery. We have completed the cloning of the *Chlamydomonas* IFT172 and IFT139 (formerly designated p172 and p139) genes and have made significant progress toward cloning the IFT81 (p81) gene. We have also cloned genes encoding two of the subunits of kinesin-II, the molecular motor responsible for moving IFT particles out to the flagellar tip. With the exception of IFT81, database searching reveals that homologues of all of these genes are found in ciliated organisms such as ciliated protozoa, nematodes, insects, and mammals. Of particular interest is the selective lim binding (SLB) protein, the rat IFT172 homologue. Researchers have recently identified SLB as a protein that can selectively affect *lhx3* and *lhx4*, two transcription factors essential for the early development of motor neurons and the pituitary gland. Based on these results, we propose that IFT and cilia are involved directly with the control of specific gene transcription. Other proposed functions of IFT include the transport of ciliary building blocks out to the flagellar tip and the transport of membrane proteins. In an effort to identify proteins that interact with the IFT machinery, we have performed a series of chemical cross-linking studies coupled with immunoprecipitations. One

interacting protein of molecular mass 180 kDa was identified and analyzed using mass spectrometry. This 180 kDa contained 8 peptides, all of which are derived from the IFT88 protein, indicating that the 180 kDa protein is composed of two copies of IFT88 and has now been termed the IFT88 dimer. The IFT88 dimer is present in the absence of chemical cross-linkers and is not due to a disulfide bond. The function of this dimerization is unknown. To complement our chemical cross-linking studies, we have constructed a yeast two-hybrid library using *Chlamydomonas* cDNA. This will allow us to identify proteins that interact with specific IFT subunits. We will also use the two hybrid system to analyze the architecture of the rafts themselves. In summary, we will continue to address the function of intraflagellar transport by focusing on understanding the structure of the transport machinery and identifying the proteins with whom they associate.

Impact: We have found that an Intraflagellar Transport (IFT) protein both essential for formation of cilia and flagella and is also homologous to selective lim binding protein, a mammalian protein that appears to affect gene transcription during early development. These findings suggest that cilia and IFT are important in the regulation of specific genes.

Allocated resources IAES Program 2:

RPA	SY	PY/TY	Amount
301	2.5489	1	\$243,959
302	1.5503	3	\$367,556
305	0	0	\$48,424
307	0.2	0	\$3,094
311	7.3341	2.4172	\$1,374,160
312	1.195	0	\$131,259
313	0	0	\$1,506
Total	12.83	6.42	\$2,169,958



IAES Program 3: Crop and Livestock Production Systems (RPAs 308, 402, 404, 405)

Performance Goals:

To develop marketing alternatives and product quality and consistency to meet consumer's demands. Loss of natural resources (e.g. soil and water) and agricultural inputs (e.g. chemicals) by Idaho food producers will be decreased.

Progress/Impacts:

Project Number: IDA01188

CRIS Number: 0185565

Multi-State Project: W-181

Goal: 1

Program: 3

RPA: 308

MODIFYING MILK FAT COMPOSITION FOR ENHANCED MANUFACTURING QUALITIES AND CONSUMER ACCEPTABILITY

Investigators: McGuire, M. A.

Termination Date: 09/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Conjugated linoleic acids (CLA) are fatty acids found in milk that possess beneficial properties for human health. Efforts to increase the content of CLA in milk have focused on alterations in the rumen to promote greater production of CLA during biohydrogenation. Certain CLA isomers also cause milk fat depression; an effect that may improve the economics in certain markets of milk. Direct feeding of CLA may provide a more reliable means to enhance CLA concentrations. Unsaturated fatty acids must be protected from rumen hydrogenation in order for their incorporation into milk fat. Calcium salts of fatty acids and prills are commercial means to protect lipids from alterations in the rumen. The hypotheses tested included: 1) feeding of rumen protected CLA, Ca salts or prills, was required to enrich milk with CLA; and 2) milk fat depression would only occur when rumen protected CLA was fed. Eight lactating Holstein cows were randomly assigned to one of four treatment sequences in a replicated 4 x 4 Latin square design balanced for carryover effects. Periods lasted 7 d with supplements fed d 3 to 7 of each period. A 7 d washout occurred between every period to minimize any treatment carryover effect. Treatments were safflower oil, CLA as a free oil, prills containing CLA, and Ca salts of CLA. Supplements were fed to provide 100 g of CLA per day; safflower oil was fed at a similar rate as the CLA oil. Supplements were offered once a day before the morning feeding. Daily dry matter intakes and milk yield were determined. Milk samples were collected for compositional analysis. Concentrations of CLA (c9,t11 CLA) were increased by feeding of the safflower oil, CLA oil or Ca salts of CLA. The t10,c12 CLA isomer was increased during supplementation with CLA oil or Ca salts of CLA. Milk fat depression was most evident during the Ca salt supplementation but was also detected during feeding of CLA oil. Prills containing CLA failed to elicit any change in milk composition. Conjugated linoleic acid can be enriched in milk without formation of a rumen inert form, however, the increase is less than when Ca salts are utilized.

Impact:

Feeding of Ca salts of CLA may provide a simple way to design milk for better human health as well as provide a management tool for farmers under a milk fat quota system.

Project Number: IDA01181**CRIS Number:** 0182857**Goal:** 1**Program:** 3**RPA:** 404**INTEGRATION OF NEW TECHNOLOGIES FOR IMPROVED WATER MANAGEMENT****Investigators:** King, B. A.**Termination Date:** 06/30/2004**Reporting period:** 01/01/2001 to 12/31/2001**Progress Report:**

The application of nitrogen fertilizer through center pivot irrigation systems is universally used throughout potato production in Idaho. The common method of nitrogen injection into the water stream is with a positive displacement, fixed flow rate, electrically driven pump. However, changes in center pivot system flow rate due to end gun and corner system sequencing create undesired variation in nitrogen application for the field. A new method for maintaining a flow proportional fertilizer injection rate has been developed. The concept uses power line carrier technology to provide a cost-effective data communication link between the end of the center pivot and the pivot point or beyond. The end gun status (On/Off) and pressure, and status of valves along the swing arm of the corner system are monitored by a microprocessor at the end of the pivot. A controller at the pivot point or beyond periodically requests the status. The status is used to compute flow rate of the center pivot system and adjust the injection rate of chemicals proportional to flow rate. The injection rate is controlled using a variable speed motor controller and a conventional chemical injection pump. This methodology is less expensive than using a flow meter to directly measure flow rate for adjusting the fertilizer injection rate. The goal is to test the system on a commercial center pivot system during the 2002 cropping season.

Impact:

Changes in center pivot system flow rate due to end gun and corner system sequencing create undesired variation in nitrogen application rate. The developed system provides a less expensive alternative to the current approach for maintaining flow proportional chemical injection with center pivot irrigation systems.

Project Number: IDA01182

CRIS Number: 0184324

Goal: 1

Program: 3

RPA: 402

ENGINEERING OPPORTUNITIES TO ENHANCE AGRICULTURAL PROFITABILITY

Investigators: Peterson, C. L.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

The goal of this project was to evaluate locally developed yellow mustard cultivars to determine their suitability as low cost feedstocks for biodiesel. Rapeseed, Canola, and Yellow Mustard are particularly well-adapted alternative crops for the Palouse of northern Idaho and eastern Washington. A 1999 Cummins powered Dodge diesel pickup and a 2001 Volkswagen, 1.9 L, diesel beetle were used for on-road testing. The truck has been operated for 23,980 miles and the VW 4617 miles on Mustard Ethyl Ester (MEE). A new 24 hp, 3 cylinder, DI engine is currently under test on a biodiesel fuel produced from Ida Gold yellow mustard. During the durability startup tests MEE power averaged 6.0 percent lower; fuel consumption was 2.2 percent higher, and Break Specific Fuel Consumption (BSFC) (hp-hrs/gal) was 8 percent higher than when operated on diesel. A series of chassis dynamometer emissions tests were run with a 1994 Dodge Cummins diesel powered pickup. The recently upgraded 602 SuperFlow Dynamometer was used to correlate emissions readings from a portable 5-gas analyzer with emissions readings obtained at the Los Angeles Mass Transit Authority testing facility with the same truck in 1997. Results of these these tests show that only the Nitrous Oxide data may be comparable. The second part of this project was to evaluate non-esterified used fryer oil from a local grocery store deli to determine the suitability for use in low level blends with diesel fuel. The machine vision system for scoring the results of injector coking was fitted with a new injector holder to decrease imaging errors and was modified by altering the existing light filter to eliminate injector silhouette blurring. Fuel blends containing from 2.5% to 20% used vegetable oil were compared with injector coking levels for 100% diesel to assess the effects on combustion chamber carbonization. The 2.5% oil/diesel fuel blend had injector coking levels similar to diesel fuel and to 10% biodiesel blends. Fryer oil/diesel fuel blends of 5% and more had injector coking significantly above diesel alone. A 1000 hour durability test with 10% used fryer oil has been completed. Power dropped initially, probably due to effect of deposits on injector spray patterns, and then stabilized for the remainder of the test. A 53 foot refrigerated trailer was obtained and is under test with a 10% used fryer oil/diesel blend. The trailer engine is operating on automatic mode and has accumulated over 300 hours on test. To date, no adverse effects or maintenance problems have been noted.

Impact:

Yellow mustard is a feedstock which has potential to reduce the cost of biodiesel especially if

some of the uses for the co-products can be developed. Using used fryer oil directly in a blend with diesel has potential to save imported oil, add value to a waste product, and reduce disposal costs for the retailer.

Allocated Resources IAES Program 3:

RPA	SY	PY/TY	Amount
308	1.5453	2	\$281,374
402	0.5	2.0123	\$180,509
404	0.8	1	\$92,677
405	0	0	0
Total	2.85	4.01	\$554,561

IAES Program 4: Farm business management, economics and marketing (RPAs 601, 602, 603, 606)

Performance Goal(s):

Provide information to policy makers and to people dealing with ranch property concerning economic values and the part that is played by public grazing rights held by ranchers. Obtain greater knowledge of international trade as it is affected by policies and trade agreements combined with a better understanding of export practices to enhance the opportunity for Idaho and the Pacific Northwest to maintain a strong export market for agricultural products. Increase availability of production and market information for organic niche products, to help modest sized farms increase income potential. Develop a model for wheat price outlook for wheat producers in the Pacific Northwest and information permitting these farmers to market wheat more effectively and/or reduce price risk. Wheat quality will be increased through development of improved storage conditions.

Progress/Impacts:

Project Number: IDA01139

CRIS Number: 0178258

Goal: 1

Program: 4

RPA: 606

GLOBAL TRANSPORTATION AND TECHNICAL BARRIER IMPACTS ON PACIFIC NORTHWEST EXPORT COMPETITIVENESS

Investigators: Jones, J. R.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

An evaluation of the conversion of Idaho's weight distance system of truck taxation to a registration system prorated on distance brackets was initiated. A quadratic programming hinterland version of PNWSHIP is being updated and adapted to looking at efficiency issues associated with converting to the new taxation system in Senate Bill 1580 and House Bill 364. A horizontal equity analysis was completed and reported to the Idaho House Transportation and Defense committee. The previous Weight Distance system was found to be much better than the new system in terms of treating equals equal. A recommendation was made to add and raise taxes for longer haul drivers and shorten them for short haul drivers.

Impact:

The findings if adopted would help restore horizontal equity in the Idaho Tax system..

Project Number: IDA01147**CRIS Number:** 0185197**Goal:** 1**Program:** 4**RPA:** 603**NICHE FOR ORGANIC FOOD****Investigators:** Foltz, J.**Termination Date:** 06/30/2003**Reporting period:** 01/01/2001 to 12/31/2001**Progress Report:**

Work continues on this project and on a related USDA Initiative for Future Agriculture and Food Systems (IFAFS) program grant - "Understanding, Evaluating, and Improving Direct Marketing Strategies of Small Farms in the PNW." Part of this project looks at organic production. The study is in the process of developing 12 whole farm case studies and direct marketing budgets for 4 of the most commonly used direct marketing strategies (farmers markets; Community Supported Agriculture; on-farm sales; and direct to retail). In addition, this project will also 1) develop an input-output model to attempt to quantify some of the impacts of small and organic farms on local economies; 2) quantify the impact of farmers markets in the region (ID, WA & OR), including the value of organic produce sold via this manner.

Impact:

This project will evaluate and quantify the economic impact and potential of organic agriculture in Idaho - from a production agriculture and agribusiness perspective.

Project Number: IDA01148**CRIS Number:** 0179214

Goal: 1

Program: 4

RPA: 606

TRADE REFORMS, MARKET POWER, AND EFFECTS ON PROCESSED FOOD AND PRIMARY COMMODITY MARKETS

Investigators: Devadoss, S.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Trade reforms strongly influences the U.S. food processing industries and agricultural commodity markets. Examining the characteristics of the food manufacturing sector are critical in analyzing the trade reform effects on processed foods industries and bulk commodity markets. Particularly, the noncompetitive behavior of the food processing firms needs to be considered. We undertook theoretical and empirical analyses of market size and consumer preference asymmetries to examine the implications of trade and trade policies for imperfectly competitive food manufacturing sectors. The results showed that the effects of trade reforms on imperfectly competitive product trade are counter intuitive if a significant portion of food trade is attributed to market size and preference asymmetries. For example, countries with smaller markets gain relatively more from trade liberalization than countries with large markets because export market opportunities are greater for small countries than for large countries. In a theoretical study, we examined the curvature of production possibility frontier (PPF) of a model consisting of two final goods (one good is a processed food), one intermediate good (raw agricultural commodities), and two primary factors. One final good and the intermediate good are produced using primary factors, labor and capital. The second final good (processed food) is produced using labor and the intermediate input. Producers of the second final good exert oligopsonistic market power on the intermediate input purchase. This study generates results that are not adherent to the standard two-sector Heckscher-Ohlin model. Some of the results that deviate from the H-O model are the relationships between factor prices and commodity prices, price-output effect, tangency between price line and PPF, and the curvature of PPF. In another study, we compared the trend in the growth of the processed food sector to that of farm sector. The United States accounts for about 25 percent of processed food production in the developed countries. The U.S. processed food sector is growing because of the increased domestic and foreign demand. Over the last three decades, the processed food sector has grown much faster than the farm sector. In 1972, the value of processed food production was 1.89 times more than the cash receipts from the marketing of farm commodities. In contrast, in 1995, the value of processed food production was 2.37 times more than the cash receipts from farm commodities. U.S. high-value product exports rose from \$6.03 billion to \$34.07 billion between 1975 and 1997, an increase of 465 percent. In contrast, bulk commodity exports rose from \$15.8 billion to \$23.3 billion between 1975 and 1997, an increase of only 47.6 percent. Value added by the processing sector has also grown at a faster rate than the value-added by the farm sector. The food processing sector generated \$35.5 billion in value-added

in 1972, which increased to \$124.8 billion in 1996. In contrast, value-added by the farm sector increased from \$18.5 billion in 1972 to \$51.6 billion in 1996.

Impact:

The results of this study will benefit the food processing industries in evaluating the effects of trade reforms on their sales, and also help these industries to focus on where to sell their commodities.

Project Number: IDA01192

CRIS Number: 0184984

Goal: 1

Program: 4

RPA: 601

ECONOMIC ANALYSIS OF AGRICULTURAL PRODUCTION, SUPPLY AND POLICY IMPACTS

Investigators: McIntosh, C. S.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Research on nutrient management requirements for livestock was completed for the US Broiler industry. Impacts of phosphorus-based nutrient legislation were shown to be slight (less than 1 percent decrease in production). Further research on nutrient management will look at farm-level impacts. Research on specification of agricultural supply/demand models was concluded. The study examined the appropriateness of three different statistical estimation techniques. Results showed substantial efficiency gains from imposing inequality restrictions, with the Bayesian approach to such restrictions being slightly better than inequality restricted maximum likelihood estimators. Research into the economics of Idaho potato production will be ongoing. Specific topics examined will include production and price risk, and the economic impact of seed borne potato virus Y.

Impact:

While a cost increasing policy, such as nutrient management requirements, will have a negative impact on the US broiler industry, that impact would not result in major changes in production patterns. Results of the model specification research provide economists and agricultural economists with a sound reason for choosing the Bayesian estimation method over the standard maximum likelihood estimation. This will result in more efficient estimates of elasticities, which in turn will result in more accurate policy analysis. Research on potato risk magnitude and sources will provide growers and processors information beyond what is included in standard cost and returns estimates. Cost of production data is used in economic impact studies and to evaluate the cost effectiveness of new production technology, as well as to substantiate emergency pesticide

registration requests. Cost and risk estimates are also needed when evaluating the benefits and costs of alternative crop rotations or management practices.

Project Number: IDA01207

CRIS Number: 0186773

Goal: 1

Program: 4

RPA: 601

STUDY OF IDAHO FARMLAND VALUES, TRENDS, EXPLANATIONS, IMPLICATIONS

Investigators: Nelson, J.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report: In-depth analysis of factors affecting farmland values in South-central Idaho have been completed (reported in article listed herein, in other papers and in other articles under review and forthcoming). The hedonic pricing technique was used to determine the effect of specific attributes on farmland values in South-central Idaho. The following specific conclusions were generated by the study: 1. Two farmland markets exist in South-central Idaho, one for small size tracts and the other for large tracts, smaller tracts having a higher equilibrium price per acre than larger tracts. 2. Time has an influence on farmland values. Generally tract values increase throughout time. However, in the study area, and likely in other local areas, negative local economic conditions often override the general upward pressure of time (inflation, increased productivity) for individual years. 3. Farmland values decline as elevation and slope increase. Elevation affects growing season, thus increases risk and reduces crop alternatives. Slope increases erosion potential and increases cost of farming. 4. As soil productivity increases, farmland values increase. More productive soil will lead to greater returns on farmland. 5. Net farm income increases farmland value. As farming units have greater disposable income, demand for farmland increases, leading to an increase in value. The above results are being utilized by farmland appraisers as they consider what variables they should include in their analyses of farmland values in the study area and in similar areas. Further research determined that development related characteristics on farmland (distance from town, distance from roads, elevation, county population) affect farmland income multipliers (IM's) ($IM = \text{parcel value}/\text{gross rent}$). Conceptually, an income multiplier is the inverse of a capitalization rate. Results indicate that high IM's on farmland are caused by development related variables, indicating that IM's can be used to evaluate, at least in an ordinal sense, development pressures on farm farmland values. Comparative analyses of agricultural income multipliers for farmland for which farming is truly the highest and best use, and of agricultural multipliers for farmland that is under high pressure for conversion to development, should yield good estimates of the agricultural value and the development value increment components of the farmland with development potential. This information could be quite useful to local government officials and decision makers with nonprofit entities who are working to preserve farmland and agricultural areas by use of such

mechanisms as purchasable development rights, transferable development rights and farmland trusts.

Impact:

Project results to date provide useful information to appraisers, public policy makers (such as planning and zoning boards), local government officials (such as county assessors), and current and prospective land owners as they try to evaluate economic pressures on farmland values. Appraisers can use results to determine important variables in appraisal process for study area and similar areas. Policy makers can use results to better understand pressures to develop farmland and related issues (use value, value of development rights, patterns of development).

Project Number: IDA01209

CRIS Number: 0185654

Goal: 1

Program: 4

RPA: 602

EVALUATING RISK MANAGEMENT ALTERNATIVES FOR THE PACIFIC NORTHWEST

Investigators: Makus, L.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Impacts of alternative risk management strategies for PNW grain producers are being analyzed using a representative dryland operation in north Idaho. Alternatives being assessed include 3 crop insurance products (Multi-peril Crop Insurance, Crop Revenue Coverage, and Income Protection) and hedging. Revenue streams over a 10-year period using the risk management alternatives are compared to a base scenario of selling all grain at harvest. Revenue streams are compared using a mean-variance approach. Preliminary results suggest hedging provides higher returns with less variability relative to the other strategies. Data on basis patterns for alternative classes of wheat in the PNW are being updated and maintained. Analysis of basis behavior focuses on the white wheat cash prices relative to Chicago Board of Trade futures. White wheat basis is being modeled using an econometric approach. Price outlook is conducted and published three times per year for grains and livestock. Outlook is published in print and electronically on the AERS Department website (<http://www.ag.uidaho.edu/aers/>).

Impact:

This work enhances the ability of participants in commodity markets to more effectively manage the risk associated with greater commodity price variability. Increase understanding of marketing and risk-management alternatives available to agricultural producers in the Pacific Northwest.

Allocated Resources IAES Program 4:

RPA	SY	PY/TY	Amount
601	1.6885	0	\$135,624
602	0.7	0	\$65,924
603	0.9	0	\$97,960
606	1.625	0	\$160,722
Total	4.91	0	\$460,230

Goal 2: A Safe and Secure Food and Fiber System

IAES Program 5: Food Safety and Quality (RPAs 501, 502, 503, 504, 711 and 712)

Performance Goal(s):

A better understanding of flavor chemistry as related to sensory properties of selected red cultivars of grapes used in Idaho wines. Obtain additional information on the occurrence, effects and mechanisms of action of toxicants and antitoxicants in food. Improve diagnostic tests for microbial pathogens present in food and better education of the public on food safety issues.

Progress/Impact:

Project Number: IDA01202

CRIS Number: 0189810

Goal: 2

Program: 5

RPA: 501

INVESTIGATIONS OF WHEAT AND POTATO QUALITY AS A FUNCTION OF STARCH CHARACTERISTICS AND BEHAVIOR

Investigators: Huber, K. C.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

To assess the Rapid Viscoanalyzer (RVA) as a screening tool for differentiating potato genotypes according to end-use quality, a factorial design was used to identify RVA run parameters and RVA measurements that provided the greatest potential for discrimination. Efforts focused on two cultivar extremes, R. Burbank (high quality, mealy texture) and IdaRose (poor quality, waxy texture). Prior to RVA analysis, potato material was peeled, cubed, freeze-dried, and reduced to powder. The RVA experiment utilized 5 levels of heating rate (2, 3, 4, 6, and 8 degrees C/minute), 5 levels of peak temperature (75, 80, 85, 90, and 95 degrees C), and 3 levels of flour concentration (2.5, 3.0, and 3.5 grams). The experiment was replicated three times. Correlation coefficients between the various RVA measurements identified Peak, Breakdown (strong correlation with Trough, Tot. Setback), Final (strong correlation with Trough, Rel. Setback), and Time to Gelatinization as the most important RVA measurements for distinguishing cultivars. Redundant measurements (Trough, Tot. Setback, and Rel. Setback) were eliminated from further study. To identify combinations of RVA run parameters that provided best discrimination of cultivars, 3-D surface plots were constructed for each selected RVA measurement. The RVA easily discriminated R. Burbank and IdaRose cultivars on the basis of Breakdown, Time to Gelatinization, Peak, and Final viscosity. Based on these findings, 6 sets of optimum RVA run parameters were selected for further investigation using an expanded set of cultivars. The RVA shows great promise for predicting potato end-use quality. To investigate the role of starch granule size and chemical composition on wheat flour and starch pasting behaviors, Native, A-type, B-type, Prime, and Tailing starch fractions were isolated from flours of two SWW wheat cultivars grown at five Idaho locations. Each growing location was treated as a replicate. Native, A-type, B-type, Prime and Tailing starch fractions were comprised of variable ratios of A- and B-type granules. The Native starch fraction possessed 65-70% A-type granules and 30-35% B-type granules (weight basis). The Prime starch fraction possessed a higher proportion of A-type granules compared to the Tailing starch fraction. Large variations in apparent amylose content were observed amongst the fractions (A- vs. B-type, Prime vs. Tailings), while much smaller differences in total amylose content were detected. Thus, fractions would appear to differ more with regard to the state of their amylose (lipid-complexed vs. non lipid-complexed) rather than their actual amylose contents. In general, the higher the content of B-type granules, the higher the lipid content, and the lower the apparent amylose content for a particular fraction. The A- to B-type granule ratio appeared to account for starch and flour pasting behaviors. Both A:B-type granule ratio and starch content were correlated with flour pasting differences across growing location. Thus, fluctuations in flour pasting behavior across growing environments may be related to variable starch contents and starch granule size distributions within flours.

Impact:

Due to escalating competition in international markets, issues of end-use quality and functionality are becoming increasingly important factors that influence the purchasing decisions of potential buyers. While quality is a relative term that varies according to the particular end-use, it will be necessary to identify critical factors that dictate "quality" for specific product applications, and to provide legitimate means for defining, gauging, and targeting "quality" of raw agricultural commodities. Only as critical factors governing quality are identified can the potential to manipulate or control these factors be truly increased. This research project is intended to provide pertinent feedback for facilitation of crop improvement, which will foster competitiveness of US

agricultural commodities in the global marketplace.

Project Number: IDA01169

CRIS Number: 0184868

Multi-State Project: IR-4

Goal: 2

Program: 5

RPA: 502

A NATIONAL AGRICULTURAL PROGRAM: CLEARANCES OF CHEMICALS AND BIOLOGICS FOR MINOR AND SPECIAL USES

Investigators: Hirnyck, R. E.

Termination Date: 09/30/2003 **Reporting period:** 01/01/2001 to 12/31/2001

Progress Report:

A survey of County Extension Educators, Specialists and commodity groups identified minor use pesticide needs for IR-4 priorities in Idaho. The Idaho Minor Crop Alliance also assisted with the prioritization process. Information about the IR-4 program and its importance to minor crops at three stakeholder meetings.

Impact:

The 2001 IR-4 magnitude of residue field trials conducted by the Idaho Field Center were: cyprodinil + fludioxonil/ lima beans; dry beans; snap beans; fluroxpyr/apple; pear; fludioxinil/apple; buprofezin/pear; bifenazate/ sour cherry; sweet cherry; thiamethoxam/barley--2 studies; flumioxazin/dry bean; potato; fenhexamid/apple; spinosad/pasture grass; thiodoprid/cherry; methoxyfenozide/lima bean; thioxloprid/peach for a total of 18 studies. These studies will be used for future Section 18, 24(c) or Section 3 registrations.

Project Number: IDA01102

CRIS Number: 0171691

Goal: 2

Program: 5

RPA: 502

DEVELOPMENT OF IMPROVED WHEAT CULTIVARS FOR IDAHO

Investigators: Souza, E. J.

Termination Date: 06/30/2001

Reporting period: 07/01/1996 to 06/30/2001

Termination Report:

During the life of this research project the following wheat cultivars were released: Boundary hard red winter, Jubilee soft white spring, Lolo hard white spring, Jefferson hard red spring, Iona hard red spring, Hayden hard red winter wheat. We released four germplasms resistant to the Russian wheat aphid. Breeding materials were generated and advanced through cycles of selection to provide new cultivars for the next five years. In addition we conducted investigations into the genetics of cereal quality affecting pastry products, Asian noodles, and bread.

Impact:

Cultivars (Jefferson, Jubilee, and Lolo) released through this project are being used for identity preserved production to enhance manufacturing efficiency and farmer profitability. The genetics research will enhance the long-term competitiveness of US agriculture in the world economy.

Project Number: IDA01220

CRIS Number: 0188883

Goal: 2

Program: 5

RPA: 503

STORAGE MANAGEMENT FOR IMPROVED POTATO QUALITY

Investigators: Kleinkopf, G. E.

Termination Date: 06/30/2006

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

This project has established several objectives for future research: 1. Evaluate new and recently released potato cultivars for best storage management practices. 2. Evaluate new or registered compounds for use in the potato industry for storage disinfection and management of diseases in storage. 3. Determine efficacy of naturally occurring compounds as sprout suppressants of potatoes in long-term storage. 4. Assist industry with storage issues that cannot be evaluated without access to sound testing facilities. Project support of these objectives has been initiated and is ongoing.

Impact:

Benefits derived from this project target potato industry personnel, including growers, packers, processors and other academic units to assist the potato industry in solving problems concerning maintaining quality in long-term storage. A series of naturally occurring compounds, e.g., mint oils, have been documented to be effective sprout inhibitors for potato tubers in long-term storage.

Project Number: IDA01103

CRIS Number: 0172169

Goal: 2

Program: 5

RPA: 712

THE EFFECT OF DIET ON ESCHERICHIA COLI O157:H7 IN THE MICROBIAL FLORA OF THE RUMINANT G.I. TRACT

Investigators: Bohach, C. H.

Termination Date: 06/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

For many years it has been known that healthy ruminants transiently harbor the human pathogen *Escherichia coli* O157:H7 in their gastrointestinal tract, however, the conditions that lead to its acquisition, persistence, and clearance from that site are not clearly understood. Elucidating the relationship between cattle and *E. coli* O157:H7 may impact the development of interventions to curb its presence in ruminants and thereby reduce the incidence of human infections with this pathogen. Cattle are the main source of human infections. Studies show a nearly ubiquitous distribution of *E. coli* O157:H7 in cattle. The average duration that calves shed *E. coli* O157 is 30 days, but some animals clear *E. coli* O157:H7 from the gastrointestinal tract (GIT) in a few days while others remain culture-positive for up to one year or more. The factors that contribute to the persistence of *E. coli* O157:H7 in ruminants are mostly unknown, but likely include the ability of the bacteria to colonize a particular location within the GIT. We previously reported that fast rates of intestinal cell proliferation in the cecum and the distal colon correlate with rapid clearance of *E. coli* O157 from the bovine GIT. To complement this finding, we compared the GIT site of *E. coli* O157 and the duration animals remain culture-positive. Experimentally inoculated sheep and cattle were used as models of natural ruminant infection to investigate the pattern of *E. coli* O157:H7 shedding and gastrointestinal tract (GIT) location. Eighteen forage-fed cattle were orally inoculated with *E. coli* O157:H7 and fecal samples were cultured for the bacteria. Three distinct patterns of shedding were observed: one month, one week, and two months or more. Similar patterns were confirmed among 29 forage-fed sheep and four cannulated steers. To identify the GIT location of *E. coli* O157:H7, sheep were sacrificed at weekly intervals post inoculation and tissue and digesta cultures were taken from the rumen, abomasum, duodenum, lower ileum, cecum, ascending colon, descending colon, and rectum. *E. coli* O157:H7 was most prevalent in the lower GIT digesta, specifically the cecum, colon, and feces. The bacteria were only inconsistently cultured from tissue samples and only during the first week post inoculation. These results were supported in studies of four Angus steers with cannulae into both the rumen and duodenum. After the steers were inoculated, ruminal, duodenal, and fecal samples were cultured periodically over the course of the infection. The predominant location of *E. coli* O157:H7 persistence was the lower GIT. *E. coli* O157:H7 was rarely cultured from the rumen or duodenum after the first week post-inoculation, and did not predict if animals went on to shed the bacteria for

one week or one month. These findings suggest the colon as the site for E. coli O157:H7 persistence and proliferation in adult ruminant animals.

Impact:

Our recent finding that E. coli O157:H7 resides in the lower gastrointestinal tract and not the rumen of cattle will impact the development of interventions to curb its presence in ruminants and thereby reduce the incidence of human infections with this pathogen.

Project Number: IDA01159

CRIS Number: 0181341

Goal: 2

Program: 5

RPA: 712

GENETICS OF SALMONELLA TYPHI TRANSMISSION

Investigators: Youderian, P. A.

Termination Date: 06/30/2003

Reporting period: 02/01/1999 to 06/30/2003

Termination Report:

TERMINATION. The goal of this project was to use a genetic approach to investigate and potentially control certain gastrointestinal pathogens such as Salmonella typhi. Specifically, this group targeted for identification, Salmonella typhi genes required for growth under poor conditions in the laboratory and possibly in nature. Most of the effort was focused on bacterial genes required for growth in, or induced when growing under, harsh conditions such as water or hypotonic conditions. The results confirmed that S. typhi can survive well in a hypotonic water environment and even grows under hypotonic, nutrient limited conditions. Experiments in which S. typhi was grown in water supplemented with small amounts of LB medium, suggested that the organism can scavenge reduced sugars in the medium. The organism grew on ultrapure agarose with 0.001% LB suggesting that its growth is enhanced by exposure to a solid surface. Using these model screening systems, transposon mutagenesis experiments identified three classes of genes involved with growth under poor conditions. Some of these genes were sequenced and shown to have homologues in other pathogens such as Yersinia sp. There was significant progress in related work on bacteriophage biology which led to the demonstration that phage P1 can be used as a generalized transducing phage in S. typhi facilitating future genetic studies.

Impact:

These results will provide important information regarding Salmonella genes involved in its waterborne transmission. Some genes have already been identified and additional characterization is ongoing. The outcome of this work will impact the epidemiology and transmission of salmonellosis, one of the leading intestinal infectious diseases worldwide.

Project Number: IDA01136

CRIS Number: 0177237

Multi-State Project: W-122

Goal: 2

Program: 5

RPA: 712

IMPROVE FOOD SAFETY THROUGH DISCOVERY & CONTROL OF NATURAL & INDUCED TOXICANTS & ANTITOXICANTS

Investigators: Exon, J. H.

Termination Date: 09/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report: We have established an aging rat model that permits evaluation of the effects of natural food compounds on immune functions and/or the development of colon cancer. In animals treated with a colon carcinogen, quantification of a marker of colon cancer, aberrant crypt foci, is accomplished in formalin-fixed whole mount colon preparations. Paraffin-embedded tissue from whole mount preparations can then be further evaluated using appropriate antibodies to stain proteins associated with cell functions such as apoptosis and cell proliferation, as well as proteins associated with tumor formation and progression. Immunohistochemical staining provides valuable information on distribution and localization of cellular proteins. However, the presence of potentially cross-reacting proteins and difficulty in protein quantification can interfere with determining the role of the protein in normal or aberrant cell function. Western blot analysis is used to assess protein expression by referring to its molecular weight, and provides a quantitative interpretation of expressed proteins. Immunohistochemistry and Western blot analysis are complementary techniques, however, they have not been considered compatible for use in formalin-fixed tissues. Using the recently published method of Ikeda et al. (J. Histochem. Cytochem. 46, 1998), we are developing methods to evaluate levels of proteins such as beta-catenin and proliferating cell nuclear antigen in colons of carcinogen-treated aged rats. The beta-catenin signaling pathway is deregulated in most colon cancers. We have successfully extracted proteins from formalin-fixed tissue and continue to modify our technique to establish optimal specificity in the detection of proteins. Evaluation of protein alterations in normal and precancerous colon epithelial cells will enhance our ability to evaluate the effects of dietary compounds on colon cancer development. During this year, we have also extended our evaluation of the effects of dietary sphingomyelin (SPM) on colon cancer development in our aged rat model. Sphingomyelin is associated with various cellular functions such as apoptosis, protein kinase inhibitors and cellular transformation and differentiation. Thus, dietary SPM may alter or reverse changes in cell function that support progression of colonic epithelial cells to cancer. Using immunohistochemistry, we have evaluated a marker of cell division activity, proliferating cell nuclear antigen (PCNA), in colonic epithelial cells of carcinogen-treated aged rats fed SPM. We

have not found a clear difference in numbers of cells staining positive for PCNA in SPM fed rats compared to controls.

Impact:

The aged rat model described in this project provides important insights into effective dietary strategies for reducing colon cancer incidence and declines in immune functions common in aging humans. Examination of specific proteins in colon epithelial cells from rats previously evaluated for incidence of aberrant crypts and/or evidence of change in cell functions provides additional understanding of cell events leading to cancer development.

Project Number: IDA01219

CRIS Number: 0189493

Goal: 2

Program: 5

RPA: 504

IMPROVING CONSUMER FOOD SAFETY HABITS: REMOVING BARRIERS TO THERMOMETER USE

Investigators: McCurdy, S. M.

Termination Date: 06/30/2006

Reporting period: 07/01/2001 to 12/31/2001

Progress Report:

A consumer education brochure that explains the advantages of using food thermometers when cooking thin meats is under development. The brochure will be completed and printed during the next 6 months. Concurrently with the development of the brochure, a telephone survey instrument will be developed to gather data from Idaho consumers about home thermometer use.

Impact:

We expect this project will result in an increase in the number of Idahoans using food thermometers to assess the doneness of meats, and a resulting decrease in foodborne illnesses associated with undercooked meats.

Allocated Resources IAES Program 5:

RPA	SY	PY/TY	Amount
501	0	0	32,102

502	1.75	5.8918	478,366
503	0	0	36,163
504	0	0	3,132
711	0.2	0	48,994
712	0.7538	2	266,507
Total	2.70	7.89	\$865,264

Goal 3: A Healthy, Well Nourished Population

IAES Program 6: Human Health and Nutrition (RPAs 703)

Performance Goal(s):

Increase understanding of motivators and barriers, attitudes and knowledge about consumption across age, gender, and selected minority groups. To obtain a better understanding of how natural chemicals in the diet interact with cancer processes.

Progress/Impacts :

Project Number: IDA01108

CRIS Number: 0171729

Goal: 3

Program: 6

RPA: 703

DEVELOPMENT OF CHILDREN'S SKILLS AT MEALTIMES IN GROUP CARE SETTINGS

Investigators: Fletcher, J. W.

Termination Date: 06/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Data were collected, and are under analysis, of children's mealtime behaviors when the condition of adult eating with children is manipulated to include teacher days and no-teacher days. In a second study, data have been collected and analysis is underway for a study of commonly accepted guidelines for feeding children as they are represented in practice in Japanese child care programs. A third study is underway with data collection beginning in Feb, 2002. This study replicates a classic study by Leann Birch that examines children's tasting and looking behaviors and acceptance of new foods. Funds were secured through a multi-state, USDA funded grant to study factors that impact child care providers behavior when feeding children in group settings, and to develop a mealtime rating scale.

Impact:

Results of these studies are used to provide materials and workshops for Head Start staff and child care providers and those who educate Head Start staff and child care providers. Over 10,000 items have been downloaded from the Feeding Children Website (www.ag.uidaho.edu/feeding) where we share information and materials that have resulted from this project.

Project Number: IDA01120**CRIS Number:** 0173601**Multi-State Project:** W-191**Goal:** 3**Program:** 6**RPA:** 703**FACTORS INFLUENCING THE INTAKE OF CALCIUM RICH FOOD AMONG ADOLESCENTS****Investigators:** Gabel, K. A.**Termination Date:** 09/30/2002**Reporting period:** 01/01/2001 to 12/31/2001**Progress Report:**

After approval by the Lewiston school district, administration of the validated Calcium Rich Food Motivator/Barrier Survey and Food Frequency Questionnaire to age appropriate adolescents was accomplished. Following collection and review, 192 surveys were mailed to New Mexico State University for analysis and incorporation into regional database.

Impact:

Information gained from the survey administered to Idahoan adolescents will support the need for developing and delivering intervention programs to this at-risk adolescent population in the state. In general, the validated instrument can provide other researchers with a survey specifically designed for the adolescent population. Overall, the results from the survey can provide the basis for future projects targeted at food habits and behavior of adolescents.

Project Number: IDA01150**CRIS Number:** 0182376**Goal:** 3**Program:** 6**RPA:** 703

Childhood Feeding Practices

Investigators: Branen, L.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

We are currently analyzing videotapes of children ages 4-5 eating with and without adults at the table to determine differences in children's behaviors under the two conditions. We completed planning of a study replicating Dr. Leanne Birch's study of preschool children's consumption of novel foods; this study will be initiated in February. Data have been collected for a study comparing feeding practices in Japanese childcare facilities with US child feeding guidelines. Funds were secured through a multi-state, USDA funded grant to study factors affecting childcare providers' feeding practices. We continue to maintain and revise the website Feeding Young Children in Group Settings.

Impact:

The results of these studies serve as the basis for workshops on feeding young children in group settings to childcare providers and Head Start staff, as well as those who train childcare workers. The feeding website serves as a resource for those who train others in the best methods for feeding young children in child care and Head Start programs.

Project Number: IDA01164

CRIS Number: 0182375

Goal: 3

Program: 6

RPA: 703

EFFECT OF TEAM NUTRITION CLASSES ON SELECTION AND CONSUMPTION OF SCHOOL LUNCH ITEMS

Investigators: Raidl, M.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Several schools that were suppose to participate in the Fall 2000 study declined to participate. Therefore, additional schools were contacted. From 1/01-2001 through 5/01/01, testing was conducted on the eight nutrition education classes on 32 students, at one school and 2 after-school programs. From 5/01/2001 through 8/01/2001, data was entered and analyzed. There were 92 children that completed all eight Team Nutrition classes, activities, and pre, post, and follow-up

surveys. After completing the classes, the results showed that students were knowledgeable about the Food Guide Pyramid, made more healthy food choices, and were willing to try new food products. After completing two classes on the food guide pyramid, 88 percent of students were able to correctly classify foods into the appropriate food group. There was a significant ($p < 0.05$) increase in the number of students making healthy food choices after completing the classes. The classes exposed students to many food products (e.g. jicama, papaya, rye crackers) that had been eaten by 5-10 percent of the students, and 90-100 percent of students were willing to not only try these products but stated they enjoyed them.

Impact:

Children completing the class will increase nutrition knowledge and achieve nutrition goals related to the Food Guide Pyramid

Project Number: IDA01193

CRIS Number: 0185300

Goal: 3

Program: 6

RPA: 703

THE ROLE OF CULTURE IN INFANT FEEDING PRACTICES

Investigators: Houghton, M.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Traditional cultures usually have a high rate of breastfeeding. However, changes in infant feeding practices have been documented in groups moving from a traditional society to a more western society. The current project is designed to determine whether Mexican mothers who immigrate to the United States change their infant feeding practices. The survey instrument is being finalized. A Spanish translator has been identified and has agreed to translate the survey instrument. The survey will be field tested this spring and data collection will occur during the summer of 2002.

Impact:

The most significant impact expected from this study is that more women will successfully breastfeed their infants.

Project Number: IDA01218

CRIS Number: 0189449

Goal: 3

Program: 6

RPA: 703

PARENTS' INTENTIONS AND BELIEFS TOWARDS ENCOURAGING THEIR CHILDREN'S PARTICIPATION IN THE NATIONAL SCHOOL LUNCH PROGRAM

Investigators: Lambert, L.

Termination Date: 06/30/2006

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

A review of the literature regarding student participation in the National School Lunch Program (NSLP) is on going. Characteristics and beliefs concerning satisfaction or dissatisfaction with the NSLP, as identified by students and parents, will be viewed for potential inclusion in the School Lunch Survey being developed.

Impact:

The results of this research will contribute to a better understanding of students' beliefs towards participating or not participating in the National School Lunch Program.

Allocated Resources IAES Program 6:

RPA	SY	PY/TY	Amount
703	0.77	0	\$77,549
Total	0.77	0	\$77,549

Goal 4: Greater Harmony Between Agriculture and the Environment

IAES Program 7: Soil, Water and Air Quality Conservation and Sustainable Agriculture Practices (RPAs 101, 102, 104, 111, 112, 123, 132, 135, 215, and 216)

Performance Goals:

Reduced erosion, nutrient depletion, salination and toxification of agricultural soils coupled with increased adoption of precision soil and crop management techniques. Efficient application and utilization of water, fertilizer, pesticides, and other crop and soil amendments for biological control of pests. To meet the water quantity and quality needs of different constituents on a scientific basis through sustainable practices.

Progress/Impacts:



Project Number: IDA01180

CRIS Number: 0183542

Goal: 4

Program: 7

RPA: 111

QUANTIFICATION METHODS FOR WATER RESOURCES MANAGEMENT AND PLANNING

Investigators: Allen, R. G.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

The satellite-based SEBAL algorithm (Surface Energy Balance Algorithms for Land), for predicting evapotranspiration (ET), was applied to Landsat 5 images for the Kimberly, Idaho area (path 40 row 30) for 8 dates in 1989. Predictions were compared to ET measured by precision lysimeter for a sugar beet crop (data from Dr. J.L. Wright of USDA-ARS). Accuracy averaged 14% and was within 6% for four of the dates during the growing season. ET for the April - September period by SEBAL for the pixels of the beet field averaged 714 mm whereas ET from lysimeter totaled 718 mm, a difference of less than 1%. These results are remarkable, as the SEBAL application was independent of the lysimeter field data. SEBAL was enhanced to extrapolate instantaneous ET from the satellite image to 24-hour and longer periods using a crop coefficient (K_c) where $K_c = ET / ET_r$ rather than the evaporative fraction (EF) formerly used. ET_r enabled consideration of advective afternoon conditions and effects. ET and K_c maps are on a 30 m x 30 m grid size. SEBAL was applied to 12 images for year 2000 for a land area in southern Idaho containing Landsat paths 39 and 40 and rows 29, 30 and 31 and the Eastern Snake Plain ground-water aquifer that is of substantial importance to the economy of southern Idaho. Images were processed from both Landsat 5 and Landsat 7 satellites to increase the number of images available. Often, images were available where the dates for adjacent paths were separated by only one day by obtaining Landsat 5 images for one path and Landsat 7 images for the adjacent path. Landsat 5 images were of immense value in providing ET for similar periods between paths. The generated ET maps show variation in ET within and among individual fields caused by crop type, farming practices, water availability, and irrigation management and uniformity. The maps will be used by the State of Idaho to predict recharge of irrigation water to the aquifer and to extend ground-water pumping data to the entire plain using correlation between SEBAL ET for the pumping period and pumping measurements. Water quality samples were collected during 2001 from points along the Snake River of central southern Idaho and from return flow channels entering the Snake from surface-irrigated tracts. Wetlands were also sampled. Analyses include forms of nitrogen and phosphorus as well as sediment, pH, oxygen and temperature. Results are archived at <http://www.kimberly.uidaho.edu/midsnake/> Results show trends in water quality of the Snake River within and among years. Wetlands are shown to have a generally favorable impact on polishing irrigation return flows. Work was completed on Standardized Calculation of Reference ET. The report contains all necessary equations for the standardized calculation as well as procedures for assessing quality, integrity and

representativeness of agricultural weather data and is complemented by the REF-ET reference ET calculation software that is housed at the University of Idaho web site <http://www.kimberly.uidaho.edu/>

Impact:

This work has led to improvements in predicting evapotranspiration to improve how we manage water resources and produce food. Better irrigation management reduces impacts on water quality and quantity of river discharge. Monitoring of the Snake River has provided a baseline for comparing changes in water management practices over time. Verification and refinement of SEBAL provides the means for predicting ET with high resolution for large land areas.

Project Number: IDA01198

CRIS Number: 0185299

Goal: 4

Program: 7

RPA: 102

CHARACTERIZATION OF THE ACTIVITIES OF PLANT GROWTH PROMOTING STREPTOMYCES IN THE RHIZOSPHERE

Investigators: Crawford, D. L.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Certain Streptomyces species are rhizosphere-colonizing bacteria that enhance plant growth and crop yield, and protect plants against invasion by fungal phytopathogens. We are studying a number of such strains, particularly Streptomyces lydicus strain WYEC108. As reported previously, this strain acts as an antifungal biocontrol agent in the rhizosphere of potato, pea, carrots, beets, and other crops, and it also promotes plant growth in the absence of fungal pathogens. This past year, we have further explored the mechanisms by which strain WYEC108 enhances the growth of plants, using as a model system, the legume pea (*Pisum sativum*). We have discovered a previously unknown plant-microbe interaction between *S. lydicus* WYEC108 and pea. The interaction is potentially of great importance to the health and growth in nature of nodulating legumes. This root-colonizing soil actinomycete markedly influences pea root nodulation by increasing root nodulation frequency, possibly at the level of infection by *Rhizobium* cells. *S. lydicus* also colonizes and then sporulates within the surface cell layers of the nodules. Colonization leads to an increase in the average size of the nodules that form, and improves the lifespan and vigor of nitrogen-fixing bacteroids within the nodules. It does this by enhancing nodular assimilation of iron, molybdenum, and possibly other soil nutrients. Bacteroid accumulation of the carbon storage polymer, poly-beta-hydroxybutyrate is also reduced in colonized nodules, an indication that *Streptomyces* colonization of the nodules relieves nitrogen stress. Importantly, root nodules of peas taken from agricultural fields in the Palouse hills of

northern Idaho were also found to be colonized by actinomycete hyphae, a further indication that this is a plant-microbe interaction of importance in the field. We hypothesize that root and nodule colonization is one of several mechanisms by which *Streptomyces* act as naturally occurring plant growth promoting bacteria in pea and possibly other leguminous plants. *S. lydicus* WYEC108 is also a potent antifungal biocontrol agent in the rhizosphere. Thus, it serves a dual purpose of protecting the plant from pathogens while also promoting plant health and vigor. Preliminary evidence indicates that this interaction occurs in other legumes such as soybean, and that other *Streptomyces* strains isolated from plant rhizospheres have similar capabilities to *S. lydicus* WYEC108.

Impact:

A better understanding of the mechanisms by which specific beneficial rhizosphere microbial populations enhance plant growth, improve crop yields, and protect crops against fungal root diseases help develop better soil and crop management practices in U.S. agriculture. By promoting beneficial plant-microbe interactions we may reduce reliance on the use of chemicals in crop management. Thus, U.S. agriculture can be more productive while being more environmentally benign. *Streptomyces*, including *S. lydicus* WYEC108 are already being used commercially as biocontrol agents in U.S. agriculture. Our hope is to extend the uses of this and other beneficial rhizosphere microorganisms to the improvement of crop growth and yield even in the absence of pathogen pressure. If so, we can improve American farm productivity significantly.

Project Number: IDA01170

CRIS Number: 0182373

Goal: 4

Program: 7

RPA: 101

INFLUENCE OF VOLCANIC ASH AND LOESS ON THE FORMATION, PROPERTIES, AND MANAGEMENT OF IDAHO SOILS

Investigators: McDaniel, P. A.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

This project is focusing on wind-blown silt and volcanic ash parent materials. We are continuing to study perched water tables in the Palouse region using naturally occurring (Cl⁻ and oxygen-18) tracers to help determine regional recharge rates. Our research has shown that tracer movement of up to 7 m/day can occur via preferential flow; movement of 1-3 m/day occurs as piston flow. Analysis of Cl⁻ and 18O distributions in deep cores indicates that very little deep recharge of groundwater occurs through many of the upland soils of the region having dense subsoil layers. Pore water retention times derived from Cl⁻ distributions suggest soil water in these soils is

trapped and recharge rates are less than 0.29 cm/year. Oxygen-18 signatures further indicate that pore waters located several meters below the soil surface are relatively old, and perhaps date to glacial times. We are working with the NRCS, and the US Forest Service to develop an Andisol database linking productivity to andic influences in forests of northern Idaho. A MS student project is examining the influence of volcanic-ash in soils of central Idaho and northeastern Oregon as it relates to properties such as plant-available-water-holding capacity and forest productivity. The principal investigator continues to serve as the Idaho Agricultural Experiment Station representative for the National Cooperative Soil Survey program.

Impact:

Soil horizons exert a strong influence on near-surface water flow in many loessial landscapes. Many soil horizons in loessial soils are dense and prevent deep recharge through upland landscape positions. In forests of the Inland Pacific Northwest region, productivity is attributed to the presence of volcanic ash-influenced soils. The extent and properties of these soils are being determined in this project.

Project Number: IDA01143

CRIS Number: 0177725

Goal: 4

Program: 7

RPA: 102

PLANT AND SOIL TEST CALIBRATION FOR IRRIGATED CROPS IN SOUTHERN IDAHO

Investigators: Brown, B. D.

Termination Date: 06/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

All field studies related to the irrigated winter wheat response to residual N measured in the spring were completed in previous reporting periods. Spring soil test N was every bit as effective as fall soil test N for predicting the response to fertilizer N, and often superior because they better reflected over-winter leaching or high N mineralization. Cooperative Extension Fertilizer Guides for both irrigated winter and spring wheat were published. The field trials for spring planted onion response to residual and spring applied fertilizer N were also completed in earlier reporting periods and a fertilizer guide published. Onion studies were conducted to evaluate fall N sources and conventional spring N applied to onions. Results after two seasons indicate that fall applied N is less effective than commonly used spring side dressed N, but that fall applied slow release N sources are more effective than conventional urea N broadcast in the fall. One time fall applications will not entirely substitute for spring sidedressed N despite using more expensive

slow release N sources. An additional field study was initiated in fall 2001 for the coming season.

Impact:

The onion information should prove useful in educating producers, fieldmen, and consultants on N best management practices used for onion production. The wheat information made possible an extensive revision of both the irrigated winter and spring wheat fertilizer guides.

Project Number: IDA01172

CRIS Number: 0183245

Goal: 4

Program: 7

RPA: 102

BIOCHEMISTRY OF SULFUR CYCLING IN THE SOIL ENVIRONMENT

Investigators: Morra, M. J.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Comprehensive methods for the measurement of transitory sulfur species in soil extracts are not available. A simple, direct polarographic method has been developed for semi-quantitative analysis of transitory aqueous sulfur species. This method provides minimal disturbance to sulfur species equilibria, has application towards extracts of amended soils, and is particularly suited for analysis of low concentrations of sulfur species (<5mM). These species have been placed into groups based on similar polarographic responses, which correspond to bonding environments of sulfur atoms contained within each species. Evaluation of groups is possible using pH 5 acetate and pH 8 phosphate buffers. These groups include sulfide, cysteine, thiosulfate, and sulfite for which the detection limits are 24, 128, 256, and 47 mM, respectively. In separate studies, we developed a method to measure ionic polysulfides. Our primary goal was to develop a polarographic technique that could be used to directly determine total ionic polysulfides in the presence of other sulfur species such as polythionates and sulfide. A technique to determine ionic polysulfides using differential pulse polarography was developed at a dropping mercury electrode in an aqueous carbonate buffer (pH 9.5). The technique was based on the potential-dependent adsorption and desorption of sulfide, the product of polysulfide reduction at the mercury electrode. Strong adsorption to the mercury electrode surface was displayed by sulfide ions from about -600 to -1000 mV as revealed by a mercury surface tension study. The study also revealed that at potentials much more negative than -1000 mV, adsorption of sulfide ceased. The potential dependent adsorption process resulted in a differential pulse polarogram that had a minimum with a magnitude proportional to polysulfide concentration. The presence of sulfide and thiosulfate did not cause any interference in polysulfide determination. A 1:1 polythionate to polysulfide ratio caused a lowering of sensitivity in polysulfide detection, but polysulfide measurement was still possible. The technique is applicable to samples containing polysulfides with polysulfidic sulfur

concentrations ranging from 10^{-5} M to 10^{-3} M. The developed methods were used to follow intermediates produced in cysteine-amended soils. Five different soils were amended with cysteine and incubated at 37°C for up to 16 d under waterlogged and non-waterlogged conditions. Cysteine concentrations decreased rapidly and thiosulfate-S species were formed. Potential precursors in the production of thiosulfate include cysteine thiosulfonate and S-cysteinesulfonic acid. Thiosulfate-S species declined in most of the soils by the end of the 16-d incubation period. A correlation of a small sulfide-S response to a thiosulfate-S response suggests low concentrations of species such as pentathionate that contain both types of sulfur. The pathway for COS and CS₂ production thus includes the participation of partially oxidized organic and inorganic species. These highly reactive species interact with soil constituents to produce gaseous S compounds.

Impact:

Improved methods are now available to monitor sulfur species in soil sediments. This will give researchers additional tools with which to monitor sulfur cycling within these matrices. This is significant since sulfur is important in both environmental quality and agriculture.

Project Number: IDA01191

CRIS Number: 0184841

Goal: 4

Program: 7

RPA: 111

ASSESSMENT AND DEVELOPMENT OF METHODOLOGIES TO RAPIDLY ASSESS BMPs TO REDUCE SEDIMENT AND NUTRIENT RUNOFF FROM AGRICULTURE IN IDAHO

Investigators: Mahler, R. L.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

A BMP effectiveness evaluation study initiated in 2000 was completed in 2001. This study was conducted on gully plugs and sediment basins installed in the Winchester Lake Watershed in northern Idaho to reduce both sediment and P loading into Winchester Lake. This site was chosen because it is a high priority TMDL watershed in Idaho. In theory the number, placement and capacity of structures placed within the watershed would allow both the P and sediment TMDLs to be achieved. In practice however, installation of structures alone was not enough to reduce the surface water pollution problem. Data collected within the watershed showed that only about 60% of the BMP structures were retaining the sediment load they were designed for. The 40% failure rate is unacceptable to both regulatory and technical agencies. The major problem was the lack of maintenance of the structures by farmers. The average structure had a life span of only six years. This study showed that the implementation of BMPs without long-term monitoring of the BMP structures might cause an implemented TMDL program to fail. The results of this study will be

used to develop extension and educational programs in 2002 that emphasize the importance of both installation and maintenance of BMP structures. Four northern Idaho fertilizer guides (bluegrass seed, winter barley, winter rapeseed, winter wheat) were revised in 2001 to improve N and P recommendations which will benefit the state's TMDL implementation effort.

Impact:

The results of the Winchester Lake Watershed study will encourage both regulatory (US-EPA, state Idaho Division of Environmental Quality) and technical agencies (USDA-NRCS, Idaho Soil Conservation Commission) to monitor the long-term maintenance of BMP structures implemented to meet TMDL goals within watersheds.

Project Number: IDA01226

CRIS Number: 0189094

Goal: 4

Program: 7

RPA: 104

RATES AND MECHANISMS OF CHEMICAL REACTIONS IN SOILS

Investigators: Strawn, D. G.

Termination Date: 06/30/2006

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

This project encompasses two experimental systems. The first is to investigate the reaction mechanisms of Pb and Cu on clay minerals. The second is to investigate the reaction mechanisms for P in manure amended soils. We have recently collected XAFS spectra on the clay mineral samples at Stanford Synchrotron Radiation Laboratory on beamline 4-3. Preliminary analysis of the data for Cu sorption on montmorillonite, kaolinite and vermiculite show distinct local atomic shells for various pH and ionic strength equilibrations, indicating that unique sorption products were present on the clay minerals. High loading of Cu on the clay minerals was achieved by incubating them at low solid solution ratios. High loading levels are critical for obtaining good signal to noise ratios, yet are difficult to obtain without high concentrations of metal that may saturate the solution forcing precipitation. We have also developed a method for incubating clay films at various hydration values and preserving these sample conditions for analysis via x-ray diffraction. Preliminary results indicate that the interlayer spacing of the clay mineral is sensitive to equilibrium conditions and hydration status. Current research efforts are in data analysis of the XAFS spectra and setting up additional experiments to verify sorption products. We have developed a collaboration at the D.O.E. Environmental Molecular Science Laboratory (Richland, WA) that will allow us to perform EPR experiments on the Cu-sorbed clay samples. The desorption experiments from the manure amended soils indicate that P release is slow, and continues for times as long as 7 days. Preliminary results suggest that the soluble organic P component in these soils is negligible. We conducted adsorption and desorption isotherms for

ortho-P and phytic acid on calcium carbonates. Since the soils in southern Idaho are calcareous, results from these experiments are directly applicable to the disposal of manure in these soils. The isotherm experiments revealed that the calcium carbonate has a much higher affinity for phytic acid than ortho-phosphate, and in both cases sorption was irreversible.

Impact:

Soils consist of a mixture of various minerals, soil organic materials, and organisms. Thus reactions in soils are also heterogenous, requiring experiments designed to gain an understanding of the underlying mechanisms. The research in this project provides insights into the reactions of P, Pb, and Cu with soils and clay minerals, which will help design improved soil management and remediation strategies.

Project Number: IDA01187

CRIS Number: 0185087

Multi-State Project: W-190

Goal: 4

Program: 7

RPA: 132

AGRICULTURAL WATER MANAGEMENT TECHNOLOGIES, INSTITUTIONS AND POLICIES AFFECTING ECONOMIC VIABILITY AND ENVIRONMENTAL QUALITY

Investigators: Hamilton, J.

Termination Date: 09/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Some of the work during the period was done under the project Pacific Northwest Irrigation, Climate Change, and Institutional Adjustment funded by NOAA in cooperation with the Climate Impacts Group at the University of Washington. This project addresses the effects that climate change could have on the hydrology, irrigation water supplies, hydropower generation, and instream flows for fish. The work starts from the macro-scale climate results from the literature, and then uses the Modsim model to particularize these effects to the Snake River basin with its unique hydrology, water structures, irrigation demands, and water allocation institutions. The work will address ways in which the impacts of climate change might be mitigated - such as greater use of water markets. The work in progress is described in the web page <http://www.uidaho.edu/~joelh/Projects/ModsimView/ModsimView.htm>. Since 1997 I have served as one of eight economists selected by the Northwest Power Planning Council on their Independent Economic Analysis Board (IEAB). The Power Council plays a major role in policy and decision-making with respect to Pacific Northwest power, water, and endangered salmon

issues. The purpose of the IEAB is to advise the Power Council on issues of economics and economic analysis, primarily related to the Council's fish and wildlife program. This work links very closely to other work on water policy, endangered species, and regional economics. The most recent work of the IEAB addresses how water acquisition, probably through market mechanisms can be used to augment streamflow for the benefit of anadromous fish. The IEAB web site at <http://www.uidaho.edu/~joelh/IEAB/IEABPage.htm> presents some of the work of the IEAB. Another thread of my work has looked at the electricity price disruptions of recent months, and especially the impact on the Pacific Northwest. Idaho Power Company bought out 500 million kwh of irrigation pumping electricity from 150,000 acres of deep-well and high-lift river pumping land in southern Idaho at 15 cents per kwh in anticipation of power shortages this summer and winter. The present electricity price is about 2 cents. A final piece of work relates to the measurement of damages in interstate lawsuits involving water. In *Kansas v Colorado* I testified that the damages to Kansas because it was deprived of water from the Arkansas River included secondary damages to the economy of the surrounding community and state. This reasoning was persuasive to both the special master and the US Supreme Court. The decision, announced in June 2001, is one of a very few precedents for including secondary damages in a legal judgment.

Impact:

This work has helped agencies (e.g., Idaho Dept of Water Resources, Idaho Attorney General's Office, NW Power Planning Council, US Bureau of Reclamation) make better water policy decisions.

Project Number: IDA01206

CRIS Number: 0186914

Goal: 4

Program: 7

RPA: 102

AGRICULTURAL WATER MANAGEMENT TECHNOLOGIES, INSTITUTIONS AND POLICIES AFFECTING ECONOMIC VIABILITY AND ENVIRONMENTAL QUALITY

Investigators: Walker, D. J.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

We continued work on the two-state cooperative project funded by the USDA to develop a multi-disciplinary, integrated systems model for investigating dairy waste management strategies. We have developed an EXCEL spreadsheet program, the Dairy Manure Systems Planner for alternative dairy waste systems and are now in the process of Beta testing and review. The Dairy Manure Systems Planner costs out dairy waste management systems and estimates the effectiveness of the system in terms of nutrient outputs. Dairy Manure Systems Planner program is a user-friendly spreadsheet format that will elicit planning parameters and estimate the cost and

returns of alternative dairy waste systems. The program uses a combination of user specified data as well as pre-defined data tables containing various dairy system options. A machinery subsystem calculates the annual ownership and operating costs for each machine employed on the dairy using a large database of machinery parameters contained within the model. The economics model will also estimate the value of applying the manure to fields on the dairy and in the vicinity of the dairy. A fertilization module was developed that contains climate data to calculate the rate of nitrogen volatilization during manure handling and storage. This will provide the basis for determining the nutrient value of the dairy waste applied to crops and pasture. Two major systems for handling and storing dairy waste, drylot storage and recycle flush, were evaluated for the dairy producer and as the data source for the multi-objective program. Options and variations of these two general system components can be specified by the dairy decision maker to compare costs and returns for alternative systems. Dairy manure systems for several dairies in Idaho and Washington were costed out with the program. The protocol for life cycle costing of the systems was established using annual equivalent value in a real (versus nominal) analysis.

Impact:

The decision support system provides a useful tool for economically efficient nutrient management for a sustainable dairy industry

Project Number: IDA01203

CRIS Number: 0187572

Goal: 4

Program: 7

RPA: 135

ASSESSING CAUSES OF VOLE POPULATION OUTBREAKS USING ENVIRONMENTAL CORRELATES

Investigators: Murray, D.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

In order to test the hypothesis that vole population outbreaks can be predicted using environmental correlates, we established trapping grids in three distinct weather regions located in southern and northern Idaho (Burley-Rupert; Blackfoot; Moscow) in order to obtain baseline data on vole densities within these climatic zones. At each site, two replicate 5-hectare trapping grids were located on non-cropland adjacent to active agricultural land. Voles were livetrapped and marked with numbered eartags, and physical attributes recorded (age, sex, mass). The Moscow sites also were subject to more intensive study related to population estimation procedures, potential sampling bias, and optimization of methods of livecapture. Over 450 voles were captured during the 2001 trapping season. Vole density was highest on the Moscow trapping grids, averaging approximately 15 animals per hectare (range: 12 - 17.4 voles/hectare). An examination of

demographic parameters indicated that adult and male voles were more numerous than juvenile (2.1:1.0 adult:juvenile ratio) and female (1.3:1.0 male:female ratio) voles. Vole densities at the southern trapping areas were quite low, indicating these populations were at or near the bottom of their cyclic growth curve. At the Burley-Rupert area, we estimated a minimum of 2.7 voles per hectare (range: 2.2 - 3.3 voles/hectare). Similar to Moscow, adult voles were more numerous than juveniles; however, sex was more evenly distributed between males and females. During 2001 poisoned bait sales and reports of vole infestations were low in the Blackfoot and Burley agricultural districts relative to previous years, lending credence to our results suggesting vole populations in these areas were at cyclic lows in 2001. These findings may be somewhat fortuitous in that, over the duration of this study, we will likely be successful in documenting the entire cycle of population growth, from low to high, and thus correlate these population changes to environmental variables. In addition to gathering baseline data on vole densities, we began collecting data on local weather conditions for each trapping location. Using US Bureau of Reclamation and University of Idaho weather station data, we documented 2001 monthly minimum, mean, and maximum mean temperatures, as well as monthly precipitation for each area. We also collected this data for the two previous years in order to determine whether there is a time delay in vole population changes due to weather in years past. Correlation of vole population rate of change and environmental correlates will be examined following acquisition of 2002 vole demographic data.

Impact: None to report

Project Number: IDA01125

CRIS Number: 0175121

Goal: 4

Program: 7

RPA: 112

POLLUTANT TRANSPORT MODELS TO DETERMINE CRITICAL SOURCES AREAS IN WATERSHEDS

Investigators: Boll, J.

Termination Date: 06/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

The Soil Moisture Routing model (SMR), a physically-based distributed hydrologic model created at Cornell University was modified to fit conditions in the Camas Prairie Region of northern Idaho and eastern Washington. Modifications include improvements in estimation of lateral conductivity over vertical conductivity, distributed snow accumulation and melt, and adjustments for deep percolation into a bedrock reservoir. Modifications were based on data from a small research watershed in Troy, ID, using a dense piezometer network, a circular flume at the watershed outlet,

and an 18 m x 30 m research plot. The ratio of lateral to vertical conductivity ranges from 2 to 10 for soils of the region. Currently, these ratios and drainable porosity relationships are incorporated in the model to simulate the distributed and integrated response at the research and management scale watershed. The SMR model was applied to Paradise Creek watershed, and all agriculturally dominated watersheds of the Clearwater Basin. At the larger scale, it was evident that the Soil Survey identified a restrictive layer near the surface with low vertical conductivity in nearly all soils, and that a loss coefficient for water permanently lost to deep percolation was needed. It appears that at the larger scale, watershed boundaries for surface water may not coincide with boundaries for groundwater. Correlation of runoff generating areas with soil and land use properties validated the assumption of saturation excess overland flow using in SMR. Application of the Revised Universal Soil Loss Equation showed that areas that yield high soil loss do not always coincide with areas that generate high runoff, and vice versa. Field experiments and theoretical analyses of soil erosion derived a coefficient for soil erodibility for different tillage and land management conditions. Laboratory research on phosphorus (P) showed that flow pathways and biogeochemical conditions can explain the release of phosphorus from sloping land. Relationships for the P enrichment ratio and the P extraction coefficient near Cascade Reservoir are similar than those found in the eastern USA despite much higher soil P in our study area.

Impact:

The understanding of pollutant transport at the field scale fills an important gap between scientists and state and government officials. These research findings provide database parameters for prediction of the pollution potential of site-specific areas in the watersheds and modeling tools to assist TMDL development and evaluation of BMPs in anticipation of current and future needs in Idaho. This work also plays a role in the watershed assessment related to fish habitat.

Project Number: IDA01184

CRIS Number: 0183541 **Multi-State Project:** W-128

Goal: 4

Program: 7

RPA: 102

MICROIRRIGATION TECHNOLOGIES FOR PROTECTION OF NATURAL RESOURCES AND OPTIMUM PRODUCTION

Investigators: Neibling, W. H.

Termination Date: 09/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Plot mini-sprinklers were used on a silt loam soil at a wheat crop site and on a sandy loam soil on a malting barley site to evaluate the impact of differences in late-season irrigation water

management on crop yield and quality. Conventional solid set sprinklers were used on a third site. Final irrigation resulting in a full soil water profile at soft dough-stage produced optimum yield and quality. Earlier irrigation cutoff reduced crop yield, and in some cases, test weight. Later cutoff gave about the same or slightly reduced yield but sometimes reduced test weight or protein content. Bi-wall drip irrigation tape placed on the soil surface was used to evaluate its potential for small-scale irrigation of tomatoes, potatoes, bell peppers and onions. Outlet spacing was 16 inches and tape discharge was 0.4 gmp/100 feet. Water supply was media filtered canal water. Yield and quality of the crops were excellent. Early season crop uniformity would have been improved with an 8- or 12-inch emitter spacing, but a longer spacing was used to give a larger flow path and minimize emitter plugging. By harvest, crop size and quality was uniform throughout the plots. Media filtration was acceptable for a surface water supply with significant silt loading at times.

Impact:

Optimum timing of the last irrigation on wheat and malting barley can produce high crop yield and quality while minimizing irrigation water required and potential for environmental damage due to surface runoff or deep movement of soluble crop nutrients. In many cases, optimum cutoff will result in 2-3 less irrigations, with corresponding reductions in labor and energy costs, and in water used. Utilization of drip irrigation in market garden-sized fields can save water, produce a more uniform, higher quality crop, and minimize weeds and foliar disease pressure. Information collected will help producers design and manage small-scale market garden systems.

Project Number: IDA01210

CRIS Number: 0185452

Goal: 4

Program: 7

RPA: 102

ALGORITHM DEVELOPMENT FOR REMOTE SENSING OF IDAHO WATER RESOURCES AND FIELD BURNING

Investigators: Qualls, R.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

During the reporting period we conducted a field experiment and developed a mathematical model to simulate radiative transfer/energy flux processes within a plant canopy. The field experiment was conducted in a winter wheat field from the end of May, 2001 through the middle of August, 2001. The field measurements included a core data set of infrared canopy temperature measurements, leaf area index (LAI), and incoming and outgoing long- and short-wave radiation components. Supporting measurements included eddy correlation momentum, heat and water vapor fluxes, wind speed, air temperature, humidity, and soil moisture, temperature and heat flux.

The infrared canopy temperature measurements included temperature profiles and measurements from above the canopy viewing the canopy through a range of view angles. In order to collect these temperature measurements, we built a moving carriage to transport infrared thermometers up and down through the canopy for the profile measurements and through a range of view angles above the canopy. We also modified the infrared thermometers we were using in order to narrow the field of view of the sensor in order to increase the vertical spatial resolution of the profile measurements. Great care was taken to calibrate all of the instruments following the modifications. The radiation/flux model accounts for multiple reflections of radiation in multiple layers within the canopy. We are currently writing the computer code to carry out the computations. Model output will include heat and moisture (evapotranspiration) fluxes and temperature profiles of the canopy. The field data will allow us to validate the model fluxes and temperature profiles.

Impact:

This project will enable modifications to be made to numerical weather models, such as those to generate the 10-day weather forecast, which will improve their accuracy. Furthermore, it will allow the models to begin incorporating remote sensing data such as satellite surface temperature measurements. This latter accomplishment will produce models with much greater spatial accuracy. One of the important scientific outcomes of this research will be to determine the characteristic behavior of the canopy temperature profiles and how radiation interacts with vegetation structure and density to generate these profiles.

Allocated Resources IAES Program 7:

RPA	SY	PY/TY	Amount
101	1.72	0	\$96,085
102	5.8091	2	\$1,098,408
104	0	0	\$6,626
111	1.6597	0.0504	\$176,766
112	0.5	2	\$281,513
123	0	0	\$41,137
132	0.87	0	\$126,352
135	0	0	\$4,597
215	1	0	\$101,998
216	0	0	\$0
Total	11.59	4.05	\$1,933,482

IAES Program 8: Pollution control and natural resources (RPAs 133 and 605)

Performance Goals:

One of the primary projects in this program deals with the economic costs of soil erosion and methods to reduce erosion. Both income effects and health concerns are addressed. A second major goal is to provide a safe environment for the public.

Progress/Impacts :

Project Number: IDA01165

CRIS Number: 0183322

Goal: 4

Program: 8

RPA: 605

THE ECONOMICS OF RANGELAND MANAGEMENT, IMPROVEMENTS AND CHANGES IN LAND USE POLICIES

Investigators: Rimbey, N. R.

Termination Date: 06/30/2004

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

A cooperative research project to assess the social and economic impacts of public land policies was completed with the Bureau of Land Management (BLM), Idaho Department of Lands (IDL), the Lower Snake District Grazing Advisory Board and Owyhee County, Idaho. Results have been used to formulate a Resource Management Plan (RMP) by the BLM. Papers have also been published in a symposium proceedings. Work is continuing on this project to develop ranch-level and regional economic models that will be used in a multi-state research project (W192). Similar methodologies and models will be used in 6 western states to analyze the economic impacts of public land policy issues. Expertise was also provided to the Policy Analysis Center on Western Public Lands (PACWPL) on a project dealing with the use of Pinon and Juniper biomass from western public lands to generate power. Reports on this project will be released by PACWPL in early 2002.

Impact:

Resource management policy alternatives for 1.8 million acres of public lands were formulated with better information relating to the social and economic impacts than had each agency and interest gathered data and performed their own analysis. Economic models have also been used by the county to analyze zoning changes.

Project Number: IDA01208

CRIS Number: 0185472

Multi-State Project: W-192

Goal: 4

Program: 8

RPA: 605

RURAL COMMUNITIES AND PUBLIC LANDS IN THE WEST: IMPACTS AND ALTERNATIVES

Investigators: Van Tassell, L., Rimbey, N.

Termination Date: 09/30/2001

Reporting period: 07/01/2000 to 09/30/2001

Termination Report:

A cooperative research project to assess the social and economic impacts of public land policies was completed with the Bureau of Land Management (BLM), Idaho Department of Lands (IDL), the Lower Snake District Grazing Advisory Board and Owyhee County, Idaho. Results have been used to formulate a Resource Management Plan (RMP) by the BLM. Papers have also been published in a symposium proceedings. Work is continuing on this project to develop ranch-level and regional economic models that will be used in a multi-state research project. Similar methodologies and models will be used in 6 western states to analyze the economic impacts of public land policy issues. Pricing data was collected for involved states and a stochastic price generation model was developed to create the input data for the ranch-level models. Expertise was also provided to the Policy Analysis Center on Western Public Lands (PACWPL) on a project dealing with the use of Pinon and Juniper biomass from western public lands to generate power. Reports on this project will be released by PACWPL in early 2002.

Impact:

Resource management policy alternatives for 1.8 million acres of public lands in Idaho were formulated with better information relating to the social and economic impacts than had each agency and interest gathered data and performed their own analysis.

Project Number: IDA01146

CRIS Number: 0178085

Goal: 4

Program: 8

RPA: 133

PEROXIDASE-SUBSTRATE INTERACTIONS AS A MODEL FOR DESIGN OF BIODEGRADABLE COMPOUNDS

Investigators: Crawford, R. L.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

In the past year we have constructed cDNA libraries from different stages of growth of the brown rot fungus *Gloeophyllum trabeum*. The goal of this project is to demonstrate that a cDNA library can be constructed from mRNA isolated from *G. trabeum* and used to make comparative message microarrays of *G. trabeum* cultures in order to identify gene(s) responsible for the production of methoxylated benzoquinones secreted by *G. trabeum*. The second goal of this research is to identify differences between idiophaseic and trophophasic stages of fungal growth at the level of transcription and identify genes involved in lignocellulose degradation. Recent research shows that brown rot of wood decay is a non-enzymatic process involving methoxylated quinones. The methoxyquinones are present in *G. trabeum* cultures grown on minimal medium at 2 weeks with a maximum levels at 4-6 weeks, but still detectable at 12 weeks. Total RNA from cultures grown for 2, 4, and 8 weeks was extracted using a modified TRIzol extraction method. We used Qiagen's Oligotex procedure for purification of poly A+ RNA from total RNA, followed by a cDNA synthesis and subtractive hybridization. We are presently refining the mRNA isolation and cDNA cloning procedures. The cDNA will be transformed into blue script in *E. coli* and grown on minimal media plates. Using a BioRobot's Biopick unique ability to distinguish blue colonies from white colonies, the media plates will be picked for white colonies, and the colonies will be placed into 96 well plates. The 96 well plates will be grown to mid-log phase. Using a Qiagen 3000 BioRobot the deep well blocks will be used in an automated plasmid prep to extract cDNA fragments. After being cut from the vector and purified, cloned fragments will be arrayed onto glass slides with a BioRobotics MicroGrid I. Using currently developed protocols, the slides will be hybridized with two probes. The first will be a Cy-3 labeled probe constructed from material from the 14-day time period. The second will be a Cy-5 probe from the 4, 8, 12, and 14 weeks time periods. Using Axon GenePixA Scanner and GenePix 3.0 software, unique clones that are up or down regulated will be determined. If the level of regulation is high, then that clone will be sequenced. The sequenced information will be used to determine homology to any known genes. From these searches additional probes (e.g. different growth substrates) can be constructed to hybridize against the slides.

Impact: Basidiomycetes belonging to brown rot are one of the most important degraders of lignocelluloses especially in coniferous forest. They also cause large losses to US and world economy by degrading wooden structures. By understanding the mechanism of wood degradation by these fungi we may prevent some of these losses.

Project Number: IDA01151

CRIS Number: 0178730

Goal: 4

Program: 8

RPA: 133

GENETIC AND BIOCHEMICAL ANALYSIS OF ZINC TOLERANCE IN ARABIDOPSIS AND RICE

Investigators: Caplan, A. B.

Termination Date: 06/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

We have isolated 2 zinc-induced rice genes, *salT* and *rezA*. In order to obtain more direct evidence that these genes contribute to zinc tolerance, two constructs were built and introduced into rice. One construct was intended to produce a foldback RNA capable of promoting gene silencing, and the other to produce a simpler antisense RNA. Phenotypic analysis was then performed on seedlings of the 2nd or 3rd generation. To do this, 6-9 sterilely grown seedlings were transferred after 1 week to defined plant growth medium supplemented with 0, 50, 75, or 121 mM NaCl, or with 0, 1.0, 3.0, and 6.0 mM ZnCl₂. The length of each seedling was measured after day 1 and day 6 of this treatment and compared with the length of untransformed plants (germinated without hygromycin) maintained in the same way. A statistical analysis of 13 lines showed that 1 line behaved like its untransformed progenitor, 9 showed varying degrees of hypersensitivity to both Zn⁺² and Na⁺, and 3 showed extreme sensitivity to both ions. Plants belonging to this last class were completely inhibited at 75 mM NaCl and 6 mM ZnCl₂ whereas the parental line was only 30-35% inhibited at the same concentrations. One plant line was also obtained with an antisense construct using our other gene, *rezA*. This line showed the same degree of hypersensitivity to both ions as the previous lines. Attempts to obtain transgenic rice, tobacco, or Arabidopsis lines overproducing either *rezA* or *salT* have so far failed. The reasons are not clear, but could indicate that the bacteria have lost an essential virulence function, or that overproduction of the proteins is toxic. Studies are currently underway to test each of these possibilities. In another set of studies, we have constructed novel zinc binding proteins in vitro. To do this, oligonucleotide sequences for five zinc-binding motifs have been synthesized and concatamerized in different combinations with each other. Each library was cloned into a yeast expression vector (pYES2, Invitrogen, Carlsbad, CA) containing one of two 'protein back-bones'. Each backbone encoded an amino-terminus to direct the finished molecule either to the endoplasmic reticulum (ER) or the cell surface, two compartments likely to contain comparatively few zinc-sensitive proteins essential for cell survival. Out of the first libraries made, 2 P450-based clones were selected based on their colony size on 9 mM ZnCl₂-supplemented minimal medium. Strains harboring CT3-1 and MT2-2 grew like strains with plasmid pYES: P450 when zinc was absent. All of the strains grew slower when zinc was present, however, in the time that it took the latter strain to form colonies with a diameter of 1 mm, CT3-1 and MT2-2 colonies had grown to 1.4 mm. When the inserts were sequenced, CT3-1 had 1 additional base 5' to the cloning site that shifted the reading frame of 2 copies of 1 of the oligonucleotides. MT2-2 (which came from a mixed ligation) had 2 antisense copies of 1 oligonucleotide followed by 1 sense copy of another ligated into a vector that had lost one base 5' to the cloning site.

Impact:

Studies with the salT and rezA genes may reveal much about metal accumulation in rice. Novel zinc binding peptides have been constructed which may clarify the biological requirements for engineering proteins to trap metals. It may eventually be possible to create proteins specific to any metal of economic importance. Second, these peptides may be used to reduce zinc accumulation in living cells and identify some of the processes dependent on it.



Project Number: IDA01228

CRIS Number: 0189705

Goal: 4

Program: 8

RPA: 133

CHEMICAL PROPERTIES AND BIOLOGICAL FUNCTIONS OF PYRIDINE-2, 6-DITHIOCARBOXYLIC ACID (PDTC), A METAL CHELATOR PRODUCED BY PSEUDOMONAS SPP.

Investigators: Paszczynski, A. J.

Termination Date: 06/30/2006

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Pdte, a natural metal chelator produced by *Pseudomonas stutzeri* and *Pseudomonas putida* that promotes the degradation of carbon tetrachloride, was synthesized and studied by potentiometric and spectrophotometric techniques. Pdte can be produced not only biologically, but also synthetically through a relatively simple method, allowing experiments to be performed with very pure preparations of the molecule and its metal complexes. However, no previous research has yielded quantitative data on the stability of these various pdte-metal complexes. Hence, we focused our experiments on potentiometric and spectrophotometric studies of pdte with several metals. Our goal was to determine stability constants and relative binding strengths for pdte and several of the physiologically important metals that it binds. The first two stepwise protonation constants (pK) for successive proton addition to pdte were found to be 5.48 and 2.58. The third stepwise protonation constant was estimated to be 1.3. The stability (affinity) constant for iron(III), nickel(II), and cobalt(III) were determined by potentiometric or spectrophotometric titration. The results show that pdte has strong affinity for Fe(III) and comparable affinities for various other metals. The stability constants ($\log K$) are 33.93 for $Co(pdte)_2$; 33.36 for $Fe(pdte)_2$; and 33.28 for $Ni(pdte)_2$. These protonation constants and high affinity constants show that over a physiological pH range the ferric-pdte complex has one of the highest effective stability constants for iron binding among known bacterial chelators.

Impact:

The microbial metabolite pdte [pyridine-2,6-bis(thiocarboxylic acid)] can potentially be used for in situ bioremediation of subsurface environments by either mobilizing or immobilizing toxic

heavy or transition metals and radionuclides. The pdtc:Cu(II) complex catalytically degrades carbon tetrachloride (CT); this property of pdtc holds great promise for making significant contributions to solve certain CT contamination problems.

Project Number: IDA01211

CRIS Number: 0185453

Goal: 4

Program: 8

RPA: 133

APPLICATION OF COUPLED ABIOTIC/BIOTIC PROCESSES FOR THE REMEDIATION OF CONTAMINATED SOILS

Investigators: Hess, T.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Work on the EPA funded project "Fenton-Like Reductions for the Enhanced Desorption and Degradation of Biorefractory Contaminants" was continued. The project sought to define reaction conditions and products, both oxidative and reductive, for Fenton-like reactions with highly oxidized nitroaromatic wastes such as TNT and TNB. Our work showed TNT- and TNB-hydroperoxide compounds formed as one-electron reduction products prior to further oxidative transformations. The additional work was necessary to ascertain the mechanism of one-electron reduction, whether from hydroperoxyl radical or hydroperoxide anion and is currently unanswered. Work from the project should lead towards expanding the remediation options currently available for highly oxidized, hazardous substances found on many contaminated sites in the U.S.

Impact:

The work is expected to lead to cost-effective methods for remediation of nitroaromatic compound-contaminated soils beyond those currently available.

Allocated Resources IAES Program 8:

RPA	SY	PY/TY	Amount
133	1	1.	\$288,983
605	.5838	0	\$115,509
Total	1.84	1.0	\$404,492

GOAL 5: Enhanced Economic Opportunity and Quality of Life For Americans

IAES Program 9: Economic Enhancement, Improved Quality of Life (RPAs 601, 607, 608, 801, 802, 803, 901 and 903)

Performance Goals:

1. To improve the social and economic well-being of rural communities in Idaho by providing data and information on local demographics, interactions between components of the community, and planning for economic growth of the geographic unit
2. Determine how work factors (e.g. time, support, and control) enhance or impede family performance and well-being
3. Explain the consequences of family/work interaction for family members and workplace
4. Increase understanding of parents' feeding of infants and young children and the development characteristics of eating skills for young children
5. Increase understanding of culture and the mealtime environmental factors that facilitate development of self-feeding skills.

Progress/Impacts:

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<p>Project Number: IDA01119 CRIS Number: 0173586 Multi-State Project: NC-208 Goal: 5 Program: 9 RPA: 901</p> <p>IMPACT ANALYSIS AND DECISION STRATEGIES FOR AGRICULTURAL RESEARCH</p> <p>Investigators: Araj, J.</p> <p>Termination Date: 09/30/2001 Reporting period: 10/01/1996 to 09/30/2001</p> <p>Termination Report: The State Agricultural Experiment Station database is updated to 2000 and reorganized by program areas with direct economic and environmental benefits. The program areas include waste management and utilization, breeding and variatal development, biotechnology, biocontrol of pests, bio-remediation of hazardous waste, weed control, etc. Expenditure data for all projects were collected and analyzed for the 1997-2001 five-year research program period to analyze the second five-year phase of the database. The simultaneous equation model with selectivity was completed and funding decision for agricultural research was analyzed. The results show that total receipts, return to research investment, and geographic region affect resource allocation to</p>

maintenance, applied, and basic research. Funding decision for farm production research and post-harvest research is being analyzed. Export panel data for major agricultural commodities were obtained and the impact of research on U.S. exports of agricultural commodities is being analyzed.

Impact:

Analyzes factors effecting funding decisions of the state agricultural experiment station using a computerized database.

Project Number: IDA01135

CRIS Number: 0176563

Multi-State Project: W-162

Goal: 5

Program: 9

RPA: 608

RURAL ECONOMIC DEVELOPMENT: ALTERNATIVES IN THE NEW COMPETITIVE ENVIRONMENT

Investigators: Cooke, S. C.

Termination Date: 09/30/2002

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

In 1996, Idaho voters rejected a property tax limitation initiative. Before the election, proponents claimed the decrease in revenues would be offset from the increase in economic activity. We developed a computable general equilibrium model based on tradable and non-tradable sectors to hypothesize the impact on Idaho's public finances, household income, and economic growth with and without the Initiative's tax policy. The model predicts that each \$3 reduction in property tax revenues would result in a \$2 loss in state and local revenues overall. The benefits are predicted to be \$35 per low-income household and \$738 per high-income households.

Impact: We argued that the trade and non-traded sectoring scheme is both conceptually more precise and deductively more consistent than the Waters et al. (Land Economics 73(1):72-89) goods and services approach in which traded and non-traded goods and services are intermixed. Like most CGE models, the government sector behaves within this model as an entity that only purchases privately produced consumption goods and reallocates purchasing power from the private to the public sector through the collection of taxes. There was neither an accounting of the value of the public infrastructure to firms nor the utility households receive when consuming public goods, i.e., fewer government services affect neither economic productivity nor consumer utility. Finally, we predict that for every \$3 reduction in property taxes there would be a \$2 loss in state and local tax revenue.

Project Number: IDA01192

CRIS Number: 0184984

Goal: 5

Program: 9

RPA: 601

ECONOMIC ANALYSIS OF AGRICULTURAL PRODUCTION, SUPPLY AND POLICY IMPACTS

Investigators: McIntosh, C. S.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Research on nutrient management requirements for livestock was completed for the US Broiler industry. Impacts of phosphorus-based nutrient legislation were shown to be slight (less than 1 percent decrease in production). Further research on nutrient management will look at farm-level impacts. Research on specification of agricultural supply/demand models was concluded. The study examined the appropriateness of three different statistical estimation techniques. Results showed substantial efficiency gains from imposing inequality restrictions, with the Bayesian approach to such restrictions being slightly better than inequality restricted maximum likelihood estimators. Research into the economics of Idaho potato production will be ongoing. Specific topics examined will include production and price risk, and the economic impact of seed borne potato virus Y.

Impact:

While a cost increasing policy, such as nutrient management requirements, will have a negative impact on the US broiler industry, that impact would not result in major changes in production patterns. Results of the model specification research provide economists and agricultural economists with a sound reason for choosing the Bayesian estimation method over the standard maximum likelihood estimation. This will result in more efficient estimates of elasticities, which in turn will result in more accurate policy analysis. Research on potato risk magnitude and sources will provide growers and processors information beyond what is included in standard cost and returns estimates. Cost of production data is used in economic impact studies and to evaluate the cost effectiveness of new production technology, as well as to substantiate emergency pesticide registration requests. Cost and risk estimates are also needed when evaluating the benefits and costs of alternative crop rotations or management practices.

Project Number: IDA01205

CRIS Number: 0187066

Goal: 5

Program: 9

RPA: 608

INTEGRATED SOCIAL, ECONOMIC, AND FISCAL MODELS FOR RURAL IDAHO

Investigators: Taylor, R. G.

Termination Date: 06/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

The impact models have been constructed and run for several Idaho counties. A variety of issues have been analyzed with the models with the models; timber and recreation trade-offs, industry loss, recreation impacts etc. The impact of agribusiness in Idaho and various regional agricultural crops and agribusinesses have been examined.

Impact:

Idaho policy makers need accurate predictions of economic impacts on community income, employment, tax revenue, government expenditures, housing construction, retail sales and demographics. The agricultural impact studies generated by this project help frame the discussion for state policy regarding agriculture.

Project Number: IDA01207

CRIS Number: 0186773

Goal: 5

Program: 9

RPA: 601

STUDY OF IDAHO FARMLAND VALUES, TRENDS, EXPLANATIONS, IMPLICATIONS

Investigators: Nelson, J.

Termination Date: 06/30/2005 **Reporting period:** 01/01/2001 to 12/31/2001

Progress Report:

In-depth analysis of factors affecting farmland values in South-central Idaho have been completed. The hedonic pricing technique was used to determine the effect of specific attributes on farmland values in South-central Idaho. The following specific conclusions were generated by the study: 1. Two farmland markets exist in South-central Idaho, one for small size tracts and the other for large tracts, smaller tracts having a higher equilibrium price per acre than larger tracts. 2. Time has an influence on farmland values. Generally tract values increase throughout time. However, in the study area, and likely in other local areas, negative local economic conditions

often override the general upward pressure of time (inflation, increased productivity) for individual years. 3. Farmland values decline as elevation and slope increase. Elevation affects growing season, thus increases risk and reduces crop alternatives. Slope increases erosion potential and increases cost of farming. 4. As soil productivity increases, farmland values increase. More productive soil will lead to greater returns on farmland. 5. Net farm income increases farmland value. As farming units have greater disposable income, demand for farmland increases, leading to an increase in value. The above results are being utilized by farmland appraisers as they consider what variables they should include in their analyses of farmland values in the study area and in similar areas. Further research determined that development related characteristics on farmland (distance from town, distance from roads, elevation, county population) affect farmland income multipliers (IM's) ($IM = \text{parcel value}/\text{gross rent}$). Conceptually, an income multiplier is the inverse of a capitalization rate. Results indicate that high IM's on farmland are caused by development related variables, indicating that IM's can be used to evaluate, at least in an ordinal sense, development pressures on farm farmland values. Comparative analyses of agricultural income multipliers for farmland for which farming is truly the highest and best use, and of agricultural multipliers for farmland that is under high pressure for conversion to development, should yield good estimates of the agricultural value and the development value increment components of the farmland with development potential. This information could be quite useful to local government officials and decision makers with nonprofit entities who are working to preserve farmland and agricultural areas by use of such mechanisms as purchasable development rights, transferable development rights and farmland trusts.

Impact:

Project results to date will be useful to appraisers, public policy makers (such as planning and zoning boards), local government officials (such as county assessors), and current and prospective land owners as they try to evaluate economic pressures on farmland values. Appraisers can use results to determine important variables in appraisal process for study area and similar areas. Policy makers can use results to better understand pressures to develop farmland and related issues (use value, value of development rights, patterns of development).

Project Number: IDA01224-AERS

CRIS Number: 0190793

Goal: 5

Program: 9

RPA: 901

RURAL COMMUNITY WELL-BEING AND ENVIRONMENTAL HEALTH

Investigators: Wulfhorst, J. D.

Termination Date: 06/30/2006

Reporting period: 07/01/2001 to 12/31/2001

Progress Report:

Data collection is complete for the Phase I survey of the component addressing subsurface science and operations at the Idaho National Engineering & Environmental Laboratory (INEEL). Over 1,400 surveys were completed with a randomly selected sample across southern Idaho and western Wyoming to develop a baseline of attitudes and perceptions related to comparative environmental risk and trust in authority, as well as economic costs and benefits. Phase II of this project, a survey to compare responses among those employed at INEEL with Phase I survey responses, will be implemented in the Spring of 2002. Data collection for the Social Assessment of the Idaho Panhandle National Forests is 85% complete with 111 interviews and two focus groups conducted during the fall of 2001. Major findings produced in a preliminary report to the Forest Service include: 1) areas of agreement can be found in the common value of sustaining communities and sustaining forests; 2) the most intense feelings of conflict stem from a feeling of a lack of control over a community's destiny; 3) the specifics of how to attain forest health appear to be an underlying area of conflict in the region; and 4) complications for a healthy Forest Service/community relationship include the difficulty of making local decisions by Forest Service managers and entrenched characteristics of multiple groups involved in collaboration. Data collection has also been completed for a survey in southern Idaho to compare dairymen's responses to local community members responses' on perceptions of environmental consequences of concentrated dairy industry growth. Data for this project will be analyzed and submitted for publication during 2002. Additional plans are to conduct a social survey among residents in primary Idaho watersheds, including residents in bordering states who live in the same watersheds. This survey would develop comparative responses to issues of water quantity and water quality in Idaho and the surrounding region.

Impact:

The baseline information on community perceptions of subsurface science will assist technical engineers and other scientists at INEEL to determine the social feasibility of new and emerging technologies proposed to deal with radioactive contamination in the Snake River Aquifer. The Forest Service will benefit directly from the Social Assessment conducted in the Idaho Panhandle by incorporating this community input into the upcoming Forest Plan revision.

Project Number: IDA01231**CRIS Number:** 0191063 **Multi-State Project:** NC-1003**Goal:** 5**Program:** 9**RPA:** 901**IMPACT ANALYSIS AND DECISION STRATEGIES FOR AGRICULTURAL RESEARCH****Investigators:** Araji, A. A.**Termination Date:** 09/30/2006

Reporting period: 10/01/2001 to 12/31/2001

Progress Report:

The State Agricultural Experiment Station database is updated to 2000 and reorganized by program areas with direct economic and environmental benefits. The program areas include waste management and utilization, breeding and varietal development, biotechnology, biocontrol of pests, bio-remediation of hazardous waste, weed control, etc. Expenditure data for all projects were collected and are being analyzed for the 1997-2001 five-year research program period to start the second five-year phase of the database. Several PowerPoint presentations were developed to demonstrate the economic and environmental benefits of agricultural research to the State of Idaho. The simultaneous equation model with selectivity was completed and funding decision for agricultural research was analyzed.

Impact:

The findings of this study show that for every \$1 invested in agricultural research the State of Idaho's economy benefits by over \$31. The annual net present value to the State of Idaho's investment in agricultural research is about \$190 million. The results show that total receipts, return to research investment, and geographic region affect resource allocation to maintenance, applied, and basic research.

Project Number: IDA01097

CRIS Number: 0171646

Multi-State Project: W-167

Goal: 5

Program: 9

RPA: 801

FAMILY AND WORK LINKAGES

Investigators: Wanamaker, N. J.

Termination Date: 09/30/2000

Reporting period: 10/01/1995 to 09/30/2000

Termination Report:

This project examined the interactions between family and work and its consequences for family members and for the workplace. It was part of Multistate Research Project W-167. Workplace characteristics that enhanced or impeded family performance and well being were explored, as well as family factors that impeded or enhanced worker performance and well being. Our in-depth interviews of low-income, single parents took place after welfare reform had been in effect for nearly a year. The following themes emerged from our analysis of the field notes and interviews from our participants. All participants discussed the importance of welfare and public assistance in

their lives. They adamantly opposed taking advantage of the system and condemned welfare fraud, but they appreciated having a safety net available if they should need it. Another theme that emerged was related to the issue of combining paid and family work. Participants felt they could not successfully combine the two, and parenting lost out to the demands of economic support of the family. One of the things we discovered is contradictory to the assumption that single parent mothers are unemployed. All participants had a strong work ethic and had held jobs since their teen years. These jobs, however, were low paying, service sector jobs that offered little chance for advancement. Jobs alone are not lifting single parent families out of poverty. These families face other barriers to self-sufficiency. These include a lack of affordable, quality childcare. Because available employment is in service industries, parents need childcare that is available at night and on weekends. Childcare, however, is only one aspect of the larger role of parent and the constant process of parenting which is often compromised when an individual's energy and attention must be focused on the workplace. Parents often questioned their ability to parent, especially when experiencing stress. Participants lacked access to public transportation which means that childcare, medical care, and better paying jobs are less accessible. Participants often lived more than twenty miles from work or services. They often struggled to find transportation. Our findings describe a complex, multifaceted picture of families in poverty. All participants had a strong work ethic and had long records of employment. None desired to take advantage of the welfare system, but all appreciated having a safety net available if they should need it. All felt overwhelmed at times by the expectation that they simultaneously fulfill expectations as breadwinner and parent. All faced many challenges and obstacles which included finding quality childcare, reliable transportation, and affordable health insurance. The implications of these findings are directly relevant to public policy. The solutions must also be multifaceted and comprehensive.

Impact:

Contrary to stereotypes about welfare recipients, our work shows that the participants did not feel entitled to benefits nor did they like using them. Programs would be more successful in the long term if they recognized how hard these families are working to raise their children and provided the assistance programs that would make the job easier. Employers could enhance work/family well being through supervisor sensitivity to family dilemmas. Conflict occurred not as a result of employee performance, but as a result of family situations which affected performance. Assistance programs seem designed for the urban poor and do not fit rural families.

Project Number: IDA01130

CRIS Number: 0177807

Multi-State Project: W-167

Goal: 5

Program: 9

RPA: 903

FAMILY AND WORK LINKAGES

Investigators: Schmiede, C.J.

Termination Date: 09/30/2000

Reporting period: 07/01/1997 to 09/30/2000

Termination Report:

The W-167 work and family linkages project in Idaho focused on single-parent families as they struggled to combine work and family life, under the changes of welfare reform. An ethnographic approach was instituted, where participants were interviewed in their own homes, and extensive field notes were developed. Research themes emerged from our analysis of interpersonal and relationship factors that played a role in balancing work and family lives. A life trajectory we labeled 'high risk' emerged, characterized by dysfunctional families of origin, and relationship choices that led to a model we labeled 'betrayal, disheartenment and depression'. Stress, lack of social support from the partner, and violence undergirded the participants' relationship experiences. In contrast, the work domain provided opportunities to build self-esteem and feel valued. It was in their relationship experiences that our participants had challenges to their sense of self-esteem and competency as both partners and parents. The initial experiences our participants had in their families of origin, started these parents on a spiral of negative occurrences. Several participants came from families where they witnessed violence between their parents, and found themselves later with a controlling and violent partner. Partnered relationships, especially marriage are held to be the most significant source of social support in modern life. Of course, since so much emphasis is placed on the value of a good marriage, when the relationship does not measure up to these expectations, individuals may feel especially disheartened and depressed. In five cases, not only did our participants feel a betrayed by their intimate relationships, they also experienced violence directed at them and their children. Our participants who experienced violence had experiences that have been labeled 'intimate terrorism' in the research literature. Psychological abuse, as well as physical abuse, is characteristic of intimate terrorism. Intimate terrorism in our sample was perpetrated by men on both their partners, and children. The overwhelming task of doing it all resulted in depression in our sample of single parents. Although all scored within the normal range on the Beck depression scale, that was to be expected since they were all receiving anti-depressant medication, and two were involved in long-term counseling.

Impact:

When examining the lives of participants in the study, we are left with concerns that changes in public assistance programs will exacerbate the intergenerational transmission of poverty, rather than lead to self-sufficiency.



Project Number: IDA01215

CRIS Number: 0189494

Multi-State Project: W-167

Goal: 5

Program: 9

RPA: 801

FAMILY AND WORK IDENTITIES DURING TIME OF TRANSITION

Investigators: Schmiede, C.J.

Termination Date: 09/30/2005

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Quantitative measures were finalized at the October multi-state meeting. The Idaho project has quantitative measures on work and family responsibilities & identity (20 items) identity salience (20 items), depression (24 items) partner relationships (17 items) demographics (10 items) information about children, and information about work. The identity salience, work and family responsibilities, and partner relationship items are Likert type measures and were developed in conjunction with other stations on the project. Qualitative measures consisted of 20 open ended questions focusing on teen visions of career and family identities, present challenges and opportunities in work and family life, stress management, life course transitions, and partnered relationships. A power analysis was performed and our goal will be 35 women in each of two groups, divorced women, and women in intact marriages or remarriages. Data collection will take place during spring semester and summer of 2002.

Impact:

Sandpoint was identified as a community meeting the needs of the project, as well as offering opportunities for data collection that would provide additional information of rural communities facing job loss. The Coldwater Creek Distribution Center is being moved from Sandpoint to West Virginia resulting in loss of 150 jobs. These predominantly female workers also receive benefits, and the benefits are often the only ones the family unit receives. We expect the added stress of economic crisis in the Sandpoint community to have an effect on our research (the intersection of work and family transitions and job loss in a rural community).

Project Number: IDA01210-AERS

CRIS Number: 0186064

Multi-State Project: S-222

Goal: 5

Program: 9

RPA: 803

FRUIT AND VEGETABLE SUPPLY-CHAIN MANAGEMENT, INNOVATIONS, AND COMPETITIVENESS

Investigators: Guenther, J. F.

Start Date: 07/01/2000 **Termination Date:** 09/30/2003

Reporting period: 01/01/2001 to 12/31/2001

Progress Report:

Analysis of consumer acceptance of controversial foods revealed a pattern. Three products analyzed were diet soft drinks, frozen potatoes and microwave ovens. Consumers had health concerns about all three products when they were introduced. Historical consumption of these products were modelled with logistic growth functions that fit the data quite well. One common characteristic of the patterns was a long introductory period before significant growth occurred. Consumer acceptance of genetically-modified foods might follow similar patterns. A project to analyze the economics of genetically-modified potatoes in Africa was begun with a trip to South Africa in November 2001.

Impact:

The expected impact of this project is a better understanding of the economics and consumer acceptance of genetically-modified potatoes.

Allocated Resources IAES Program 9:

RPA	SY	PY/TY	Amount
601	1.6885	0	\$42,119
607	0	0	\$0
608	1.375	0	\$97,211
801	0	0	\$7,910
802	0	0	\$42,119
803	1.25	0	\$36,615
901	.875	0	\$91,624
903	0.3733	0	\$9,386
Total	5.56	0	\$326,984

IAES Allocated Resources by Federal REE Goal:

Goal	SY	PY/TY	Amount
1	44.6	29.33	\$8,797,152
2	2.70	7.89	\$865,264
3	.77	0	\$77,459
4	13.43	5.05	\$2,337,974
5	5.56	0	\$326,984
Total	67.06	42.27	\$12,404,833

Multi-state Research Projects: Research activities of the IAES that contribute to organized multi-state projects/programs approved by CSREES are designated as Regional Research Projects. Regional/multi-state research supported by Section 3(c)3 of the Hatch Act is appropriate for support of research when: 1) the research focuses on a specific and important problem of concern to two or more states, and 2) the research is planned and conducted as a concerted effort in which the participating scientists are mutually responsible for accomplishing the objectives. Multi-State (Regional) Research Projects Outlines in which the University of Idaho participates are subject to peer review and approval as stated in the policy manual of Western Association Agricultural Experiment Station Directors (WAAESD) or those of the other SAES Regions if the multi-state project originated outside of the Western Region.

WAAESD delegates responsibility for review of Western Coordinating Committees (WCC's) to the Regional Coordination and Implementation Committee (RCIC). The purpose of WCC activities is to bring research and extension (and to a limited extent academic) faculty together to coordinate related research without the need for a formal Multi-State Research Project outlines. WCC's have the authority to organize technical conferences, work groups, task forces and symposia.

In the Western Region, Multi-State (Regional) Research Fund projects must be reviewed by a maximum of four outside peer reviewers in addition to the Research Implementation Committee (RIC) appointed by the WAAESD. The RIC reviews the proposal and makes a recommendation to the WAAESD. If the proposal is approved, WAAESD Chair with assistance from the WAAESD Executive Director Office transmits the project to CSREES. The RIC also appoints Administrative Advisors to guide and administer projects and committees.

In summary, the procedures for scientific peer review employed for all IAES research projects, which have been in place for more than a decade (coupled with those of WAAESD for official Multi-State Research projects), more than comply with the peer review requirements specified in the Agricultural Research, Extension, and Education Reform Act (AREERA) of 1998.

Multi-State Research Activities

The University of Idaho is a relatively small Land-Grant institution and one whose location is relatively remote. In this context, faculty at the university have been very active in multi-state programming for a number of years as a means to interface with other colleagues in specialty areas of their disciplines and to build the critical professional mass needed to be competitive in research programming. This is especially true of research faculty affiliated with the Idaho Agricultural Experiment Station. This is reflected in our current participation in formal Multi-State (Regional) Research Projects, Western Region Coordinating Committees, and the less structured multi-state and multi-discipline collaborations that are imbedded in the majority of IAES Hatch research projects. The IAES's current Multi-State (Regional) Research Project portfolio involves participation of 23 IAES faculty in 21 different approved Multi-State Research Projects. Of these, 14 projects originate in the Western Region, four in the North Central Region, two in the Southern Region, and one in the North East Region. Currently, the IAES is spending over 27% of its Federal Hatch formula funds (\$591,700) in support of these Multi-State Research Projects plus \$336,195 in state funds. The following figures detail the IAES resource allocation to multi-state activities:

Multi-state Summary of Resources Allocated by Federal REE Goal

Goal	SY	PY/TY	Amount
1	3.86	4.81	\$532,067
2	.45	1	\$90,129
3	.14	0	\$13,284
4	1.45	0	\$111,715
5	1.97	0	\$180,700
Total	7.87	5.81	\$927,895*

*** Includes federal appropriation of \$591,700 and state dollars of \$336,195.**

Integrated Program Activities

Long before AREEA and traditionally, the Idaho Agricultural Experiment Station (IAES) and the College of Agricultural and Life Sciences (CAL S) have placed a strong emphasis on the integration of research and extension programming. This is evidenced by the fact that a large number of employees in the college have official joint research and extension responsibilities as codified in official position descriptions and combined appropriated funding from both research and extension for salaries. The IAES has 78 SY's distributed over approximately 120 faculty members. Of these, a total of 58.07 SY's representing 63 professionals are funded by a combination of research and extension appropriated resources and, accordingly, have official responsibility for both research and extension programming and the integration of these two domains of professional activity. Likewise, the IAES has a total of 155 PY's. Of this total,

30.69 PY's distributed over 35 individuals are supported by both research and extension salary resources. In summary, of the 232 full-time positions in the IAES, 88.76 positions, in excess of 1/3 of the total professional positions, are supported by a combination of research and extension funds and have responsibility for the integration of research with extension programming. The below table shows the financial commitment in salary resources to integrated programming between extension and research. The total salary commitment of \$2.5 million is in excess of the IAES's total Hatch appropriation. Accordingly, the IAES and CALS are committing in excess of four times the amount suggested/required for integrated programming between research and extension.

Total Full-Time Integrated Positions (SY's and PY's) and Salary Support

<u>Position Category</u>	<u>FTE*</u>	<u>Salary \$'s</u>
SY	58.07	\$2,072,018
PY	30.69	\$427,779
<u>Totals</u>	<u>88.76</u>	<u>\$2,499,797</u>

*FTE = full-time equivalent

Stakeholder Input

Within the College of Agricultural and Life Sciences (CALs), the Idaho Agricultural Experiment Station (IAES) relies on the avenues of stakeholder input employed across the college. The IAES plan of work was derived with the input from and has been shared with a broad cross-section of stakeholders in Idaho. In brief, the major stakeholder groups providing input regarding the IAES's spectrum of research activities (as reflected in the portfolio of IAES research projects and the plan of work) include:

- The college's Agricultural Consulting Council (ACC) which is an 80 member organization composed of representatives selected by virtually every agricultural, food system, and family and consumer science organization within the state. This advisory group has traditionally been the primary stakeholder group with which the college and IAES have had significant interactions in terms of areas of program development and emphasis and, accordingly, the plan of work. In 2001, CALS began reorganization of the Agricultural Consulting Council into a smaller more focused and dedicated group that will be know as the "Dean's Advisory Council". This new college level advisory group will be in instituted in 2002. Many members of the ACC will transition to serving on the

departmental advisory committees that have been formed in all the academic departments of CALS (see below).

- Idaho Cooperative Extension has citizen advisory groups in 42 of Idaho's 44 counties. These committees, which are composed of a very diverse and broad mix of public interests, provide input regarding extension and research program priorities from the county perspective.
- Idaho's 17 agricultural commodity commissions and organizations provide advice specific to commodity based programs and appropriate disciplines and departments within the college.
- The IAES research project portfolio and an abbreviated version of the plan of work is annually shared and discussed with representative from the executive branch of state government including the Governor's Office, the Dept. of Agriculture, and to a lesser extent, the Dept. of Environmental Quality, Dept. of Health and Welfare, and the Dept. of Commerce as well as being shared/discussed with key committees and leadership of the Idaho Legislature.
- The faculty, staff, and students (both graduate and undergraduate) of the college have a vested interest in the development of appropriate research programs of high quality that are responsive to needs of the state and region. This university stakeholder group is an important source of valuable input to the IAES and play a major role in IAES program development and delivery.

Presently the college is expanding its involvement with stakeholders by forming advisory committees for each of the eight academic departments in CALS. In the last year, all departments have established advisory committees. These committees (consisting of about 6-12 individuals) are composed from a broad base of stakeholders. In the future, these committees will be significant additional source of stakeholder input for the IAES and CALS. In addition, once a year in on-campus meetings the departmental advisory committees will meet with the CALS and IEAS leadership as well as with the Dean's Advisory Council on program priorities and directions for the college, the experiment station and the departments.

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