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USDA-CSREES
Partnerships/POW
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To Whom It May Concern:

Enclosed in this mailing the 1999-2004 Plan of Work (POW) document for the Idaho Agricultural Experiment Station (IAES), College of Agriculture of the University of Idaho. My colleagues in the Idaho's Cooperative Extension Service will be submitting the Idaho Cooperative Extension POW under separate cover in a matter of days.

We look forward to USDA/CSREES's response to our IAES POW.

Sincerely,

Richard C. Heimsch, Associate Dean and Director,
Idaho Agricultural Experiment Station

C: A. Larry Branen, Dean
LeRoy Luft, Assoc. Dean & Director
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Plan of Work

University of Idaho

College of Agriculture

Idaho Agricultural Experiment Station

Federal Fiscal Years
2000 to 2004

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

Introduction

This Plan of Work describes the research programs of the College of Agriculture and the Idaho Agricultural Experiment Station (IAES) for the next five years, as required by the Agricultural Research, Extension, and Education Reform Act of 1998 (AREERA), and described under the Department of Agriculture's "Proposed Guidelines for State Plans of Work for the Agricultural Research and Extension Formula Funds" that appeared in the April 19, 1999 Federal Registrar.

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Background Information

University of Idaho

The University of Idaho (U of I) 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 1998-99 academic year was 11,437 including 1,966 graduate students and 239 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 programs are 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 Carnegie Research II level university and ranked 84th in overall research and development expenditures among public universities and colleges in the United States as reported in 1996 by the National Science Foundation (NSF). In that ranking of 681 institutions, the University of Idaho was 26th in agricultural sciences, 83rd in chemistry, 86th in environmental sciences and 102nd in life science research expenditures. Support from research grants increased from $45.4 million in 1992 to $64.3 million in 1998.

College of Agriculture

In addition to traditional campus instruction, the College of Agriculture at the University of Idaho serves communities across the state with agricultural and family and consumer science research, and extension or "outreach." The fall 1998 enrollment totaled 987, a 4.1 percent increase from 1997 figures. The FY99 budget, including all revenue sources, was $45,280,755.

The college maintains ten agriculture research centers including the U of I campus 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 Agriculture 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 Agriculture 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

The IAES's research faculty reside in the academic departments of the college: Agricultural Economics and Rural Sociology, Agricultural and Extension Education, Animal and Veterinary Science, Biological and Agricultural Engineering, Family and Consumer Science, Food Science and Toxicology, Microbiology, Molecular Biology and Biochemistry, and Plant, Soil and Entomological Sciences. Most of the research faculty of the College of Agriculture have split appointments have additional responsibilities for academic and/or extension programming. Through its state and Federal appropriations for agricultural research, the IAES currently funds about 74 full-time faculty equivalents, which are distributed among approximately 110 faculty members, and 154 full-time technical support staff. Approximately half of the IAES's total personnel are located on the University of Idaho campus and half are located at the college's ten Research and Extension Centers across Idaho.

The research programs of the IAES cover many areas of science and include an array of diverse research activities. Examples of research program areas of emphasis include: fundamental studies in molecular genetics, molecular biology and cell biology; environmental sciences, sustainable agriculture production systems, bioremediation of toxic pollutants, human and animal health and nutrition, food quality and safety, agricultural economics, trade policy and economic and social impact analysis; microbial, insect and weed control; plant, insect, and microbe interactions; crop genetic improvement, physiology, management and production; and food animal and dairy cow physiology, reproduction, and management.

In addition to the research laboratories on campus and experimental farm facilities on campus and in the Moscow area, the IAES has an array of Research and Extension Centers (R & E Centers) throughout Idaho. These facilities consist of major research laboratory installations and many have major experimental farms. The R & E Centers are located at Aberdeen, Kimberly, Caldwell, Parma, and Sandpoint. The Tetonia R & E Center consists of a major experimental farm, but lacks research laboratory facilities. At the Aberdeen and Kimberly R & E Centers, university faculty and scientists with USDA's Agricultural Research Service (ARS) share both university and Federal research facilities and cooperate/collaborate in a spectrum of different agricultural research programs. Each of these R & E Centers is managed by a superintendent and has a farm operations staff to support the field-based research programs conducted at the center. The R & E Centers conduct research relevant to crop commodities grown in their respective areas of the state and their research activities are appropriately linked to complementary and supporting research conducted at other centers and on the Moscow campus. Example areas of research emphasis at various R & E Centers include: **Aberdeen** - potatoes,

cereal grains, and irrigation technology; **Kimberly** - potatoes, sugar beets, beans, forages; **Parma** - potatoes, cereal grains, hops, onions, corn, apples, grapes; **Tetonia** - potatoes, seed potatoes, and cereal grains; **Moscow** - peas, lentils, cereal grains, oil seeds (rapeseed and mustard), potatoes, nursery crops; **Sandpoint** - nursery crops and small fruits. Animal and veterinary science/medicine research for cattle, sheep and dairy production is emphasized at the **Caldwell R & E Center**, where the Caine Veterinary Center is located, and on the U of I Campus (**Moscow R & E Center**). Additional R & E Centers that have research faculty and laboratory facilities, but do not have experimental farms, are located at **Idaho Falls, Twin Falls**, and **Boise.** In addition, the IAES cooperates with and provides research support staff for USDA-ARS scientists located at the U.S. Sheep Experiment Station at **Dubois**. IAES scientists are members of the university's aquaculture center and conduct aquaculture research on campus and at the UI's newly acquired research facility at **Hagerman**.

In recent years, IAES scientists have been awarded an increasing number of research grants from federal agencies and commodity commissions/organizations to support their research programs. Consequently, research funding in the IAES almost doubled during the past 10 years. In 1997, external research support totaled $9.2 million compared with $5.5 million in 1985. Current appropriated resources for IAES operations included $2.02 million of Federal Hatch formula funds and $13.4 million of state agricultural research funds.

Agriculture in Idaho

Overview and Current Status: The challenge for Idaho agriculture and rural communities in the future will be to produce safe nutritious foods and other agricultural products with a sound economic base (i.e., reasonable profit margins) while maintaining environmentally sound production practices. Decreasing production costs while maintaining product quality will be key to profitability of the agricultural sector in the future. Idaho is unique compared with many states since about 65% of its lands are owned by the Federal Government. The state contains about 21 million acres of grazing lands and annually harvests 1.6 million acres of wheat, 700,000 acres of barley, 400,000 acres of potatoes and about 200,000 acres of sugar beets. Over 120 different commodities are produced, which reflects Idaho's diverse growing conditions. Agriculture and food processing is Idaho's largest industry, contributing about 25% and over three billion dollars to the state's economy. Since 1957 Idaho has led the nation in potato production. Idaho also leads the nation in production of several specialty commodities such as Kentucky blue-grass seed, food-sized trout, Austrian Winter Peas, and wrinkled seed peas. Idaho is the second leading state in the production of sugar beets, barley, lentils, dry edible peas and ranks third in the United States in production of mint, hops, fresh prunes and plums and summer storage onions. It also ranks among the top ten states in the nation for 19 crops, trout, American cheese, milk, sheep and lambs, and wool. Idaho's cattle industry ranks in the top twenty and the cattle feeding industry ranks number eleven in the country.

Short-term agricultural issues: The major short-term issue of interest to citizens of Idaho who are dependent upon agriculture is the current low prices for commodities. Efforts are underway to develop better management tools including precision farming technology, sprinkler irrigation models and preventative sprayings of fungicides for control of late blight disease in potatoes. It is also imperative to understand the epidemiology and association of *Escherichia coli* O157:H7 with dairy and beef cattle and reduce the incidence of disease in susceptible adults and children. Another important goal will be to help producers develop sustainable crop systems and reduce wastes by finding alternative uses for agricultural products and processing by-

products. Assisting producers and families in the management of the risk associated with today's agriculture will be a significant area of research emphasis.

Intermediate-term issues: Issues such as measures to decrease soil erosion and increased applications of no-till and reduced tillage farming methods will receive high priority in development of new research projects. Alternatives to traditional cropping systems and use of expensive crop protection chemicals must be found. It will be important to continue development of disease-resistant cultivars of wheat, potatoes, barley, beans, and sugar beets through the use of classical plant breeding techniques and the new techniques of recombinant DNA technology. Developing effective biological control technologies and improved integrated pest management strategies for agricultural pests will be a growing area of emphasis. Research needs of growing industries such as the dairy industry and relatively new research program areas such as aquaculture will be important in the next three to five years. It will be important to assist growers in their attempt to maintain sheep herds for production of meat and wool through genetic improvement and more efficient production methods. Also, it will be necessary to develop research based information concerning how sheep and other grazing livestock can be employed to combat perennial noxious weed invasions in Idaho and the intermountain West. The beef cattle industry will need similar kinds of assistance through basic research programs supported by the IAES. The IAES will continue to build research partnerships with Oregon State University and Washington State University focused on food quality and food safety in the Northwest.

Long-term issues: Environmental impacts of agricultural production, water quality and water and land use issues will remain a concern and a high research priority. Examples include the growing dairy industry in southern Idaho and its potential impact on the environment. Conflicts over the use of land and water between urban populations and the agricultural community will continue to develop as Idaho's urban population grows. Idaho citizens will need to make informed decisions on issues such as: breaching dams to increase numbers of salmon returning to Northwest streams, the appropriate use of public lands by parties with diverse interests and backgrounds, and the restoration of environmental systems that have been contaminated with toxicants. Research-based information will be critical for the appropriate resolution of these conflicts. Developing research programs that address the needs of the increasing number of urban stakeholders will be an emphasis area in IAES programming. In this context, food safety and the relationships between diet and health are likely to be emphasized in the future. New knowledge in genomics of agricultural plants and animals will continue as a major research focus of the U of I, other universities, and major life-science corporations. This knowledge will be applied to the development of improved plant and animals for use in agricultural systems that will provide more profit to producers, higher quality to consumers, and have reduced negative environmental impacts.

IAES Planned Programs

USDA REE Goals	IAES Research Programs	SYs	PYs+TYs
Goal 1	Program 1	17.3	40.3
Goal 1	Program 2	7.9	21.2
Goal 1	Program 3	3.0	4.3
Goal 1	Program 4	4.2	0.0
Goal 2	Program 5	1.8	3.0
Goal 3	Program 6	0.9	1.0
Goal 4	Program 7	6.4	15.7
Goal 4	Program 8	2.0	0.7
Goal 5	Program 9	4.6	0.0

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, 205, 206, 211, 212, 213)

New and improved cultivars of wheat, potatoes, and mustards have and will be developed at the University of Idaho using classical plant breeding techniques and recombinant DNA technology and molecular biology. Successful wheat breeding programs led by Dr. Ed Souza in Aberdeen, Idaho and Dr. Robert Zemetra located in Moscow have developed and are developing new soft white wheat cultivars. Brundage cultivar, a soft white winter wheat well suited to irrigated regions of southern Idaho, was released 3 years ago. Also, results with a soft winter wheat with resistance to Russian wheat aphid appear promising. Recently, Dr. Souza released a hard white spring wheat, Idaho 377s, which Asian markets have found to be superior to Australian standard white wheat for production of noodles and domestic millers have found to be superior for high-quality breads. Dr. Jack Brown is leading a research group that is developing improved mustard and rapeseed cultivars. New winter hardy Brassica species have been developed, which produce higher amounts of glucosinolates that act as natural soil fumigants. In addition, yellow mustard cultivars have been developed for biodiesel fuel (ethyl and methyl esters of the oil) while other cultivars exhibit increased competitiveness in crop rotations

compared to spring barley, peas, lentils and canola. Some of these cultivars also possess superior qualities for production of condiment mustards. Dr. Steven Love and colleagues have developed clones of Russet Burbank potatoes that possess improved appearance or grade, better french fry and elevated tuber specific gravity color after cold storage.

Various crop management systems are being evaluated to improve production and profit margins associated with potatoes, onions and small fruits. In addition to Dr. Phil Nolte's efforts to improve quality of seed potatoes, Dr. Gale Kleinkopf is working on methods to improve storage conditions and to inhibit sprouting of potatoes using natural compounds such as mint oil. Even though Washington is a leading state for production of Fugi apples, rapid progress is being made in southern Idaho by Dr. Esmaeil Fallahi with respect to spacing and tree growth, nutrient partitioning, postharvest physiology and quality of this apple. Dr. Sanford Eigenbrode is studying peas with a single-gene mutation that reduces waxbloom on the leaves and has found that these mutant peas harbor higher levels of a fungus, tentatively identified as *Pandora neoaphidis,* which cause fatal infection of pea aphids. These results suggest that effective biological control alternatives to chemical pesticides may be available in the near future.

Biotechnology/genetic engineering has been used to protect wheat, potatoes and peas against viral infections. Genes that encode for coat proteins associated with barley yellow dwarf virus (BYDV) or wheat streak mosaic virus (SMV) have been introduced into immature wheat embryos. Dr. Phil Berger has identified plants containing the gene of interest. Even though genetic engineering techniques have shown promise in the development and production of both pest resistant and tolerant crop plants, legumes have not been amenable to these molecular techniques because these plants are refractory to tissue culture methods. A novel meristem transformation procedure for peas and lentils has been developed which does not require tissue culture and results in stable transformation of both crops. This procedure, which consists of injecting and electroporating DNA into the terminal bud of young plants, has been used by Dr. Phil Berger to produce transgenic pea lines tolerant to pea enation mosaic virus (PEMV), pea seed-borne mosaic virus (PSbMV) and bean yellow mosaic virus (BYMV). A high level of resistance to infection by PEMV in transgenic peas and lentil lines expressing the coat protein gene of PEMV has been observed.

Improved weed management practices are being developed and applied throughout Idaho. Major crop weeds and noxious weeds under study by Dr. Donn Thill and other investigators at the University of Idaho include wild oat, goat grass, kochia, meadow hawkweed, yellow starthistle, yellow nutsedge, spotted knapweed and nightshade, which can serve either as a reservoir or alternate host for the fungus that causes late blight in potatoes. The importance of invasive weeds to Idaho can be illustrated by the legislature funding two faculty positions in weed science beginning in FY 2,000.

Issue(s):

Idaho producers of field and horticultural crops need consistent crop performance and the ability to address changing market and consumer demands for seed and other crop products. Production limitations must be avoided in order to meet changing market demands for produce.

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.

Output Indicators:
1. Genetic improvement of existing crop varieties
2. Development and release of new crop plants, varieties and germplasm
3. Modified crop management protocols that increase crop production efficiency
4. Reduce constraints to crop production in kind and severity arising from pests (insects, diseases, weeds)

Outcome Indicators:
1. Increased profitability for producers of field and horticultural crops
2. Reduced inputs for producers to managed crop pests and diseases
3. Increased quality, quantity, and diversity of products derived from Idaho crop plants
4. Greater consumer satisfaction and selection relative to food, feed, seed and other plant products

Key Program Components-Research projects will focus on:
1. Plant genetic manipulation to improve the performance and productivity of crop plants
2. Improved management strategies for reducing crop production and quality losses due to pests
3. Identification and characterization of biological constraints to crop plant performance

Internal and External Linkages:
Partnerships, cooperation and collaboration will involve clients and stakeholders, Idaho commodity commissions and organizations (potato, wheat, barley, alfalfa, hops, pea & lentil, bean, etc.), Idaho State Department of Agriculture, USDA-ARS scientists in the state and region, private agricultural scientists and industries.

Target Audiences:
The primary target will be producers of crop and horticultural plants in Idaho. The ultimate target audience will be regional, national and international consumers of these crop plant products.

Program Duration:	Five years	
Allocated Resources:	SYs	17.3
	PYs + TYs	40.3

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

Projects in this program focus on different life stages of domestic animals ranging from pre-conception, fetal development, nutrition and growth and protection against disease. Disease severity ranges from diarrheal diseases in newborn piglets, calves and lambs resulting in reduced weight gain and possible death to chronic long-term disease in adult animals caused by *Mycobacterium pseudotuberculosis*. Dr. Gordon Woods's studies on equine reproductive physiology have earned an international reputation and will enhance fertility and breeding practices for desired selected traits in horses and other domestic animals. Studies by Dr. Donald Robertson on the enterotoxins produced by enterotoxigenic *E. coli* are focused on protection

against disease observed in neonatal pigs, calves and lambs and development of pharmacologic agents that block the secretory response of the small intestine to these proteins. Studies in Dr. Greg Bohach's laboratory on enterotoxins produced by *Staphylococcus aureus* are likely to yield vaccines that protect against bovine mastitis. His studies strongly suggest that these proteins produced by *S. aureus* during growth in the bovine udder modulate the animal's immune response increasing the probability of serious infection. Work done by Dr. Ken Bayles in collaboration with Drs. Bohach and William Trumble is focused on understanding the virulence factors of invasive strains of *S. aureus* associated with bovine mastitis. Dr. Marie Bulgin is working on the mode of transmission and early detection of scrapie in sheep, while Dr. Jerry Zaugg is working on the epidemiology and pathogenesis of *Anaplasma* spp. in cattle. Dr. Al Ward has reported that *Pasteurellaceae* isolated from bison are comparable to those isolated from cattle in the United States with a small number similar to strains isolated from wild ruminants and pigs. The objectives of projects by Drs. Dan Hinman and Carl Hunt are designed to obtain the maximum nutritional benefit from barley and forages, respectively, for livestock production. Dr. Mark Kinsel has developed a computer model for managing diseases and their effects on production in dairy herds.

Issue(s):
A major portion of the agricultural industry of the United State involves animal production, which depends on a healthy industry, especially in the areas of beef and dairy production. Infectious diseases of animals are responsible for major economic losses of livestock due to mortality and decreased weight gain; thus, global competitiveness for U.S. agriculture production depends upon our ability to promote animal health through reduction of infectious diseases. Other important issues include development of cost-cutting production practice alternatives and improved efficiency in all production and processing arenas. Consistent high-quality meat products and a high level of food safety must be maintained.

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.

Output indicators:
1. New diagnostic procedures, peer reviewed publications, patents and licensed technologies developed for use in reducing animal infectious diseases
2. Monitoring of beef and dairy production in Idaho, Washington, and nationally
3. Support from external funding agencies, commodity commissions, and contracts from private funding sources
4. New knowledge on how pathogenic microorganisms cause animal diseases

Outcome indicators:
1. Development of new diagnostic tests for animal diseases
2. Increased profitability and competitiveness for the beef and dairy industries in the state, region and nationally
3. New livestock and dairy production systems that improve animal health

Key program components-Research projects will focus upon:

1. Understanding molecular and cellular aspects of how pathogenic microorganisms cause disease and the host animal response to the infection
2. Development of new technologies for detection, prevention and treatment of infectious diseases of animals
3. Development of vaccines to protect against animal diseases
4. Developing animal and range management technologies that are highly competitive in the global economy
5. Improved waste management practices, improved water quality and management of nutrients for limited environmental impact

Internal and external linkages:
Partnerships and collaborations will involve commodity groups associated with animal health and production, groups that support the animal industry in Idaho, the National Mastitis Council, and SAMRI (*Staphylococcus aureus* Mastitis Research Institute) which is a collaborative group of mastitis researchers from Idaho, Washington, Oregon, Korea, Ireland, and Italy.

Target audiences: Dairy and beef commodity groups in Idaho, elsewhere in the Northwest and nationally. The general public will be targeted as recipients of information concerning the benefits of animal health research and its impacts on human public health. The program will also focus on livestock, dairy, and fish producers of Idaho and the region through knowledge disseminated via peer reviewed publications.

Program duration:	Five years.	
Allocated resources:	SYs	7.9
	PYs + TYs	21.2

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

Dr. Susan Duckett has examined several pre/post harvest strategies for improving meat quality and tenderness. Pre-harvest calcium gel administration elevated longissimus muscle calcium content, increased calpain activity and accelerated postmortem aging. High corn oil diets improved marbling scores and yielded higher quality grades. Fatty acid profiles revealed a decrease in saturated fatty acid content and increased amounts of C18:2 and C20:4 fatty acids and total polyunsaturated fatty acid content. Studies by Dr. Mark McGuire are focused on altering milk fat to improve human health. His work attempts to increase the content of conjugated linoleic acid (CLA) in milk which may have anticarcinogenic properties in humans. Concentrations of CLA have been increased in bovine milk and the milk used to produce cheddar cheese for feeding trials in humans.

Dr. Brad King has developed center pivot irrigation systems capable of variable rate water and chemical applications that can be used to limit spatial variability in cropping systems for maximizing yields and reducing chemical inputs. Results showed that the amounts of petriole nitrate-nitrogen (N) varied sufficiently to warrant in-season N management zones. Soil water

holding capacity also correlated with petiole nitrate-N later in the growing season. Dr. Howard Neibling is attempting to improve potato yields by varying irrigation parameters.

Issues
Development of cost-cutting production practice alternatives, maximization of efficiency in all production and processing arenas will be important for continuing profitability and competitiveness of the livestock and dairy industries in Idaho. In addition, a high-quality consistent meat product and a safe and nutritious food supply must be maintained. Crop and animal production systems in Idaho will be improved using current computer, GPS, and sensor technologies. Through application of this technology, agricultural inputs will be decreased and productivity will be either maintained or increased.

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.

Output Indicators:
1. Increase use of variable rate applications of chemicals and water through the interface of computer expert system models with machinery/irrigation systems
2. Increase the practice of dividing fields into management zones identified by similar agronomic characteristics coupled with "in situ" sensors for improved water management

Outcomes Indicators:
1. Increased product safety, quality, acceptance, improved image of animal agriculture to the general public and profit to producers
2. Increase availability of water to expanding communities and/or irrigated crop acreage

Key Program Components-Research projects will focus on:
1. Micro irrigation and sensor technologies
2. Precision agriculture machinery/computer management and irrigation scheduling systems

Internal and External Linkages:
Partnerships include University of Idaho disciplines in production agriculture, electrical engineering, computer engineering, computer science, USDA and USDOE National Laboratories, Washington State University, Utah State University, Iowa State University, Virginia Polytechnic Institute and State University, and companies such as Idaho Power.

Target Audiences:
This program will focus on agricultural producers in Idaho.

Program Duration: Five years

Allocated Resources:		
	SYs	3.0
	PYs + TYs	4.3

IAES Program 4: Farm Business Management, Economics and Marketing (RPAs 503, 601, 603, and 606)

The long range objectives of this program are to: 1) assist producers in dealing with low commodity prices in the United States, 2) cope with market changes due to NAFTA, 3) help farmers and ranchers deal with rapid changes in agricultural practices such as no-till/direct seeding, and 4) assist producers in finding new markets for Idaho agricultural products. In an attempt to better understand the factors that determine wheat prices in the Pacific Northwest (PNW). Dr. Larry Makus has developed price outlook projections and programs for risk management strategies for wheat and slaughter cattle. Dr. James Jones has determined the economic feasibility of shipping wheat from north central Idaho to Japan. A group led by Dr. Mark Casada has determined optimal conditions for on-farm storage of wheat and found that producers must be alert to problems with FGIS-NIR instrument instability and lack of good practices in testing laboratories. Dr. Steven Devadoss has studied the effect of NAFTA and other trade agreements over the past 10 years as they influence processed food industries and bulk commodity prices. Dr. John Foltz has developed an input-output model for Idaho's dairy and dairy processing sector. Idaho was found to be competitive with the top cheese producing states of WI, CA, MN and NY. Compared with California, Idaho was the second lowest cost provider of cheese to selected cities. In an important study, Neil Rimbey examined factors that determine the market value of Idaho ranches and impact of grazing in riparian areas. His results show that providing water and supplements in areas removed from riparian areas can influence cattle behavior and production.

Dr. Gerald Schelling has determined the effect of different sources of dietary vitamin E on the quality of milk in an attempt to improve its market value. Results indicate that different forms of vitamin E exhibit different bioavailabilities and the concentration of vitamin E in milk has a direct impact on quality and lower oxidation rates that contribute to "off" flavors. In a relatively new project, Dr. John Thorngate is determining how different concentrations of wine tannins contribute to the unique bitterness and astringency profiles of Cabernet sauvignon and Pinot noir which are contain high and low levels of tannins, respectively.

Issue(s):

A primary focus of this program is on economic policy and values associated with the use and management of public rangeland, the influence of International trade and increasing export of Idaho agricultural products. Niche markets for agricultural products and organic market potential will be identified. Efficient wheat marketing in the Pacific Northwest and use of futures markets will be used to manage risk. Proper storage and transportation of cereals and oilseeds will be increasingly important in the delivery of quality products to the market since wheat stored on-farm in Idaho exhibited decreased quality after even a few weeks.

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. 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. Improve wheat quality by development of optimal storage conditions.

Output indicators:

1. Effects of grazing rights on ranchland value
2. Economic effects of more efficient transportation on agricultural exports from Idaho and the Pacific Northwest
3. Measurement of the benefits and losses associated with trade agreements.
4. Better income risk management by diversifying production
5. Greater use of a wheat price outlook model and futures markets by wheat growers
6. More uniformity of grain quality measurements between field instruments and the standard of the Federal Inspection Grain Service
7. Refine models for predicting wheat quality based on environmental and management systems

Outcome indicators:

1. Greater stability in the valuation of ranches using public grazing
2. More efficient and stable export trade and its effects on farm income with an emphasis on family sized farms
3. More efficient marketing of Northwest wheat as indicated by greater use of the futures market for reducing risk and increasing average incomes
4. Uniformity in grain quality for marketing

Key Program Components-Research Projects Will Focus On:

1. Ranchland market values
2. Better understanding of the effects of free trade agreements
3. Finding the effect of diversified production, niche markets for organic food products and marketing on farm income
4. Providing information to wheat growers to improve marketing by studying the markets and futures market techniques
5. Increased reliability of measuring instruments for environmental control and grain quality

Internal and External Linkages

Partnerships between research and extension and counterparts in the western U. S. will continue in this program. International input sources will be utilized in a cooperative fashion. The niche market effort will partner with industry and market institutions to obtain useful information. The Pacific Northwest states will cooperate on the wheat-marketing project in collecting and analyzing information. Partnerships include University of Idaho faculty in entomology, cereal grains production, the Department of Chemistry, and USDA- FGIS.

Target Audiences

The primary benefactors will be research farm and ranch operators, transportation providers, rural communities and policy makers. The focus of market research will be on Idaho and Pacific Northwest farm operators, wheat producers and smaller diversified operations, elevator operators, transportation companies, and grain brokers.

Program Duration: Five years

Allocated Resources:

SYs	4.2
PYs + TYs	0.0

Goal 2: A Safe and Secure Food and Fiber System

IAES Program 5: Food Safety and Quality (RPAs 503 and 712)

This program is relatively small; however, we intend to increase its size and emphasis in the future by adding faculty, developing special funding initiatives at the University of Idaho, and through collaborative agreements with Washington State University and Oregon State University. Dr. Jerry Exon has investigated the effect of natural food additives such as echinacea preparations on immune functions. No differences were found between control groups of rats and groups fed either capsule or tincture forms of echinacea with respect to antibody production, delayed-type hypersensitivity or natural killer cell activity. In other studies, this group observed that the young rat model used in most laboratory experiments may not predict the effect of dietary manipulation on immune function or the action of a carcinogen in an older population. Dr. Carolyn Bohach determined that pre-harvest control of diet may reduce the risk of *E. coli* O157:H7-positive cattle entering the food chain. Dr. Scott Minnich found that temperature plays a key role in regulation of virulence genes in pathogens associated with food-borne outbreaks such as contamination of milk by *Yersinia enterocolitica*. Dr. Esmaeil Fallahi has established vineyards for wine grapes and table grapes and is evaluating the fruit quality of over forty grape varieties produced under Idaho conditions and different crop management protocols.

Issue(s)

Determine the best cultivars and or clones of grape to be used for production of wine and table grapes in Idaho. Identify chemicals that can be present as either toxicants or antitoxicants in food and improve food safety. The adverse and beneficial effects of natural and synthetic chemicals in foods will be determined. Microbial food-borne pathogens that constitute a significant threat to human public health will be either reduced or eliminated. Enormous losses due to contamination by organisms with the potential to cause food-borne illnesses must be avoided. The public will be informed with respect to avoiding infections caused by contaminated food products.

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.

Output Indicators:

1. Relationship of anthocyanin content of grape cultivars and sensory analysis of wines
2. Effects of synthetic chemicals on immune function and cancer incidence
3. Success of new methods to detect and prevent food contamination

4. Peer reviewed publications; patents and licencing agreements as indicators of new technologies developed to improve food safety

Outcome Indicators:
1. Enhanced markets for the grape and wine industry of Idaho and the Northwest
2. Reduced incidence of sporadic diseases and outbreaks of food-borne illnesses
3. Reduced economic losses to food industries and producers due to microbial contamination
4. Greater understanding of the pathogenic mechanisms and epidemiology of food-borne illnesses
5. Discovery, patenting, licensing and marketing of new technologies to detect and reduce food contamination

Key Program Components-Research Projects Will Focus On:
1. Flavor chemistry and sensory aspects of wine made from grapes grown in the Northwest
2. The effects of natural and synthetic chemical on immune function and cancer incidence in animal models
3. Understanding molecular and cellular aspects of infectious diseases of the gastrointestinal tract
4. Develop new technologies for detection, prevention and treatment of food borne-illnesses
5. Development of vaccines for reducing the incidence of human infections associated with microbial contamination of foods
6. Understanding the pathogenic mechanisms of microbes associated with foods

Internal and External Linkages:
Partnerships will continue with other investigators, universities and laboratories, commodity groups and food processors in the region including United Dairymen of Idaho, Idaho Beef Council, Idaho Food Producers, Idaho Dairy Association, Idaho Grape and Wine Commission, individual production operations, private industry, and collaborative research among investigators within other departments at the University of Idaho.

Target Audiences:
Grape growers and wine producers will be the primary target of efforts to support the fledgling wine industry in Idaho. Commodity groups, regulatory agencies, food processors, consumers groups and any other individuals interested in chemical food safety. Various food producers and food industries in Idaho, the Northwest, nationally and the general public will be targeted as recipients of information concerning the risks of food borne illnesses.

Program Duration: Five years

Allocated Resources:

SYs	1.8
PYs +TYs	3.0