ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

for the
Pennsylvania Agricultural
Experiment Station
at
The Pennsylvania State University

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Goal 4: An agricultural system which protects natural resources and the environment.

Goal 5: Enhanced economic opportunity and quality of life for Americans.

Goal 1
An agricultural system that is highly competitive in the global economy.

Through research and education, empower the agricultural system with knowledge that will improve the competitiveness in domestic production, processing, and marketing.

Executive Summary: The Pennsylvania Agricultural Experiment Station continues to focus on research projects that reinforce a globally competitive agricultural system. During FY2003, 214 projects supported Goal 1 themes. The two planned projects that are featured below illustrate accomplishments and impacts within this Goal. Additional highlights include projects that contribute to agricultural biosecurity. A project examining the mode of action of plant sensor systems (receptor kinase proteins) is revealing mechanisms to modify plants to report stress. These reports would be useful in agricultural production—they could modify our pest management practices—but also might be manipulated to produce plants that can sense toxins and pathogens in human environments and report their presence to us. We are engaged in development of diagnostic tools to better identify a variety of plant, livestock, and human (foodborne disease) pathogens. Of particular note is the initial development of a comprehensive computer database to serve as a diagnostic tool for plant pathogens of special concern. Several projects are contributing to research on sustainable and organic agriculture. Hatch funds are leveraging a USDA-CSREES grant for transition to organic production, with a multidisciplinary team beginning the process of converting a portion of the AES experimental farm in Centre County, Pennsylvania, to organic practices. Continued work on tillage issues and low-input weed management practices are underway at multiple sites, including in collaboration with the Rodale Institute. We have begun a coordinated set of research projects to examine the feasibility of transitioning a portion of the Pennsylvania apple industry to organic. All of these efforts combine planned research programs with on-farm research, stakeholder involvement, and extension programming. Our sustainability strategic planning efforts have engaged approximately fifty stakeholders from state government, non-governmental organizations, farm operators, researchers, and extension personnel. Research on a variety of fronts in apiculture have led to new understanding of how the bee viruses that are devastating honey bee populations (with a depressing effect on the availability of pollination services) are transmitted within and between bee hives. Results show that honey bees attacked by Varroa mites suffer immune suppression, which exacerbates the effect of viruses in the bees.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 1 were approximately $3.75 million in FY2003, a decrease of 3.5 percent from the FY2002 level of $3.88 million. Overall expenditures tracking to Goal 1 projects were slightly higher ($37.1 million in FY2003, up nearly 4.6 percent from FY2002). State appropriated expenditures decreased by approximately $457,000 while external grant expenditures significantly increased by over 2.23 million during FY2003. Five new faculty hired during FY2003 have a significant portion of their proposed research activities within Goal 1 themes. In addition, they will also be contributing to Goals 2 and 4. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 321 graduate students can be expected to be working on research projects consistent with Goal 1 themes.

Among the hires related to Goal 1 in FY2003, we have added to our strengths in agronomic crop management, dairy genetics, development of novel wood products, and pest management using alternatives to chemical pesticides.

Many of these research results are communicated to stakeholders through a variety of methods, but we continue to rely on the close connection between Experiment Station-sponsored research and the Penn State Cooperative Extension Service. Goal 1 outputs can be directly referenced in Penn State Cooperative Extension's Annual Report of Accomplishments and Results. Further accomplishments and outputs, including publications, can be found in by searching Pennsylvania projects in CRIS at http://cris.csrees.usda.gov/menu.html. Pennsylvania researchers also rely on traditional means of disseminating information, including publication in technical, popular, and trade outlets, presentations to stakeholders and policymakers, and web-based delivery methods. Our research results reach audiences in Pennsylvania, the nation, and the world.

Multistate projects are an important part of our activity under Goal 1 themes. Thirty-one of our experiment station projects contribute to multistate projects within Goal 1 (NC-0129, NC-0131, NC-0136, NC-0140, NC-0205, NC-0221, NC-0504, NC-1009, NC-1010, NC-1119, NC-1142, NE-0009, NE-0060, NE-0127, NE-0132, NE-0140, NE-0164, NE-0171, NE-0183, NE-0503, NE-1006, NE-1007, NE-1008, NE-1009, NE-1014, S-0289, S-0291, S-0294, S-1000, W-0189, W-0195). Individual impact statements are available to 'guests' on the web at National Information Management and Support Systems at http://www.lgu.umd.edu/login.cfm.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
166.2	283.0	40.3	106.6	596.2

Total Expenditures directed to Goal ($ in thousands): [1]

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$2,972	$776	$401	$62	$16,362	$16,542	$37,116

The following agencies/sponsors provided leveraging dollars:

American Cancer Society
American Cocoa Research Institute
American Egg Board
American Heart Association
American Meat Institute
American Mushroom Institute
Andrew W. Mellon Foundation
Arnold and Mabel Beckman Foundation
Asilas Genomic Systems
Binational Agricultural Research and Development
Cadbury Chocolate Canada Inc.
California Department of Food and Agriculture
Centre for Rural Pennsylvania
Conservation Food and Health Foundation
Cornell University
Dairy Management Inc.
David and Lucile Packard Foundation
EIEICO Inc.
Environmental Protection Agency
Farm Foundation
GlaxoSmithKline
Golf Course Superintendents Association of America Foundation
International Rice Research Institute
Jem Co. Ltd.
Johnson and Johnson
Kane Chamber of Commerce
Leukemia and Lymphoma Society
Max Kade Foundation Inc.
McKnight Foundation
Monsanto Company
National Science Foundation
National Association of Animal Breeders
National Audubon Society
National Commission on Science for Sustainable Forestry
National Geographic Society
National Honey Board
National Institutes of Health
National Pork Producers Council
National Science Foundation
New York Wine and Grape Foundation
Penn State's Office of Physical Plant
Pennsylvania Department of Agriculture
Pennsylvania Department of Community and Economic Development
Pennsylvania Department of Conservation and Natural Resources
Pennsylvania Department of Environmental Protection
Pennsylvania Department of Health
Pennsylvania Department of Transportation
Pennsylvania Fish and Boat Commission
Pennsylvania Game Commission
Pennsylvania Soybean Promotion Board
Pfizer - Warner Lambert
Pioneer Hi-Bred International Inc.
Public Health Service
Purina Mills Inc.
Strategic Alliance Management Committee
Source Tech Bio Inc.
Truss Plate Institute
Udale, Richard W.
United States Agency for International Development
United States Civilian Research and Development Foundation for the Independent States of the Former Soviet Union
United States Department of Agriculture
United States Department of Defense
United States Department of Energy
United States Department of Interior
United States Golf Association
United States Poultry and Egg Associations
Washington Tree Fruit Research Commission
Whitmore Micro-Gen Research Labs Inc.

Planned Program: Nutrient Determination and Management of By-Products of Poultry Production (PEN03650)

Key Themes: Agricultural Competitiveness, Agricultural Waste Management, Animal Production Efficiency, Nutrient Management, Water Quality

Brief Description: The management of nutrients contained in poultry and livestock wastes, with the implementation of nutrient management plans, has been determined to be the best approach for abating non-point sources of pollution. This research evaluates the impact of dietary management strategies and commercial additives to reduce the nitrogen and phosphorus concentration of poultry litter and manure.

Impact/Accomplishment Statement: Findings from several studies conducted under this research project indicated that by feeding supplements of minerals to poultry or by treating their manure with minerals or bacterial cultures there may be an opportunity to reduce ammonia volatilization and keep nitrogen with the manure, thereby minimizing environmental impact and better managing this valuable crop nutrient. This research has an important impact on the poultry industry in Pennsylvania – an industry that accounts for almost $700 million in annual income at the farm level, making it the second largest agricultural industry in the state behind the dairy industry.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from American Egg Board, JEM Company Ltd., and Purina Mills Inc.

Scope of Impact: State Specific Integrated Research and Extension

Planned Program: *Pythium* Species and Population Identification and Epidemiology Using DNA Markers (PEN03685)

Key Themes: Emerging Infectious Diseases, Invasive Species, Plant Health

Brief Description: Species of the plant pathogenic fungus genus *Pythium* have a worldwide distribution and can infect a wide range of plants, causing root diseases in greenhouse floral crops. Knowing the identity of this pathogen, where the pathogens are harbored, or from where they enter the production system is crucial to formulating an effective long-term management strategy for these pathogens. The objectives of this research are to generate DNA sequence markers for the identification of *Pythium* to the species level and to generate DNA fingerprints needed to identify populations of *Pythium* within species causing losses in commercial floricultural crops.

Impact/Accomplishment Statement: An accurate method (DNA sequencing) was used to develop a database and then applied to identify the fact that *Pythium irregulare*, *Pythium aphanidermatum*, and *Pythium ultimum* are the three species currently responsible for most of the *Pythium* root rots in floral crops. Other DNA methods were used to fingerprint twenty isolates each in *P. irregulare*, *P. aphanidermatum*, and *P. ultimum* in order to determine whether different populations within each species could be identified. Individual populations have been successfully fingerprinted for *P. irregulare* and *P. ultimum*. Work is continuing on *P. aphanidermatum*. The results of this research allows scientists to isolate *Pythium* from soil and water in and around a greenhouse where *Pythium* root rot is occurring and then determine whether any of those isolates are the same as the one causing crop losses. If, in fact, one of the isolates is the same as the pathogen, the grower can then aim control measures at that specific target,

before it further infects the crop, thus improving the *Pythium* management strategy. Researchers are working with extension educators to collect samples in and around greenhouses. Fingerprints of *Pythium* populations from these samples will form a database against which new isolates can be compared. Researchers are conducting in-service training to improve extension educators' diagnostic skills and to enhance their ability to better collect and process samples. A Green Industry Round Table, held twice a year, is attended regularly by twenty-five educators dealing with the greenhouse floricultural industry in Pennsylvania – an industry that is a major contributor to Pennsylvania's economy, ranking seventh nationally in wholesale sales in 2001. Through these discussions, extension educators keep researchers informed of problems currently faced by the industry and educators are kept up to date on the ways the health of greenhouse floricultural crops can be protected.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from Source Tech Bio Inc., United States Department of Agriculture, and Whitmore Micro-Gen Research Labs Inc.

Scope of Impact: State Specific Integrated Research and Extension

Goal 2
A safe and secure food and fiber system.

To ensure an adequate food and fiber supply and food safety through improved science-based detection, surveillance, prevention, and education.

Executive Summary: The Pennsylvania Agricultural Experiment Station supports a variety of projects that contribute to safe, secure food and fiber production. During FY2003, 37 projects supported Goal 2 themes. The two planned programs featured below illustrate accomplishments and impacts within this Goal. Additional highlights include research that examines new methods for reducing microbial contamination in muscle foods. Blast chilling led to demonstrable reduction in viable microbe loads on pork products, which could provide alternative pathogen management tools to the processing industry. Electrolyzed oxidizing water was shown to be an effective tool for reducing *Listeria monocytogenes* load under laboratory conditions, suggesting a new tool for decontaminating heat-sensitive produce and other products. Additional research into the impact of composting and production conditions on subsequent pathogen load in fresh mushrooms has identified tools useful to the important mushroom industry (and consumers of those mushrooms). Careful control of pasteurization temperatures of mushroom compost led to significant pathogen reduction. Use of hydrogen peroxide and calcium chloride in mushroom irrigation systems reduced bacterial populations in fresh mushroom products and also had beneficial effects on crop quality. This information is being distributed to industry for incorporation into production practices through regular short-course sessions.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 2 were approximately $289,200 in FY2003, a reduction of 5 percent over the FY2002 level of $304,500. Overall expenditures tracking to Goal 2 projects were significantly higher ($3.1 million in FY2003, up 58.3 percent from FY2002). State appropriated and external grant expenditures significantly increased during this time period. Two new faculty hired during FY2003 would be characterized as having a portion of their proposed research activities within Goal 2 themes. These new hires will be addressing the development of new sensor technologies that will be relevant to detection of pathogens entering the food supply. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 32 graduate students can be expected to be working on research projects consistent with Goal 2 themes.

The important food processing industry in Pennsylvania maintains effective communication links to the station through the various state and national trade associations. Other stakeholder concerns on the subject

of food safety come through guidance of our Ag Council http://agcouncil.cas.psu.edu. The joint appointments that many of our researchers hold with the Cooperative Extension function of our College also provide a route for communicating stakeholder needs into the Experiment Station research enterprise.

Many of these research results are communicated to stakeholders through a variety of methods, but we continue to rely on the close connection between Experiment Station-sponsored research and the Penn State Cooperative Extension Service. Goal 2 outputs can be directly referenced in Penn State Cooperative Extension's Annual Report of Accomplishments and Results. Further accomplishments and outputs, including publications, can be found in by searching Pennsylvania projects in CRIS at http://cris.csrees.usda.gov/menu.html. Pennsylvania researchers also rely on traditional means of disseminating information, including publication in technical, popular, and trade outlets, presentations to stakeholders and policymakers, and web-based delivery methods. Our research results reach audiences in Pennsylvania, the nation, and the world.

Multistate projects are an important part of our activity under Goal 2 themes. Six of our experiment station projects contribute to multistate projects within Goal 2 (NC-0129, NC-0221, NE-0103, NE-1008, NE-1009, S-0294). One of the featured planned projects below, Pennsylvania project PEN03808, contributes to NC-0129. Individual impact statements are available to 'guests' on the web at National Information Management and Support Systems at http://www.lgu.umd.edu/login.cfm.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
16.8	19.1	1.5	10.7	48.0

Total Expenditures directed to Goal ($ in thousands): [1]

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$212	$77	$0	$0	$1,052	$1,852	$3,193

The following agencies/sponsors provided leveraging dollars:

Academy of Applied Science
Binational Agricultural Research and Development
GlaxoSmithKline
National Honey Board
National Institutes of Health
National Pork Producers Council
National Science Foundation
Pennsylvania Department of Agriculture
United States Department of Agriculture
United States Department of Defense

Planned Program: Elimination and Control of Pathogenic and Spoilage Microorganisms by Emerging Processes (PEN03783)

Key Themes: Agricultural Profitability, Food Handling, Food Safety, Foodborne Illness, Foodborne Pathogen Protection, Scientific Basis for Optimal Health

Brief Description: The Centers for Disease Control estimate that foodborne outbreaks cause seventy-six million illnesses and thousands of death a year in the United States. Treatments alone are estimated to reach over $8 billion annually in medical expenses. Efforts to decrease foodborne diseases have been tremendously increased in the last decade. This research project investigates emerging technologies to eliminate and control pathogenic and spoilage microorganisms during food processing and storage to prevent outbreaks of foodborne diseases and improve the quality of foods.

Impact/Accomplishment Statement: Several projects were undertaken in 2003 to eliminate and control pathogenic and spoilage microorganisms, including a completed project involving decontamination of alfalfa

seeds and sprouts by using ozone. The research results clearly indicated that ozone can be used as an alternative to chlorine treatment of alfalfa seeds, which will benefit the sprout industry. These research findings have been published in scientific journals and presented at several regional and national conferences. Cleaning-in-Place (CIP) of farm milking systems with acidic and basic electrolyzed oxidizing water (EO) to replace current expensive and energy-intensive cleaning practices was evaluated. The results indicated that EO water has a potential to be used as cleaning and sanitizing agent. A ten minute wash with 60°C alkaline EO water followed by a ten minute wash with 60°C acid EO water successfully removed all detectable bacteria and Adenosine Triphosphate (ATP) from the non-porous milk contact surfaces. The Northeast Dairy Practices Council and several dairy farms were interested in this novel technology. EO water was also evaluated for egg washing to decontaminate in a commercial egg washer. Log reductions of *E. coli* K12 were found to be ≥ 2.98 and ≥ 2.91 for the EO water treatment and the commercial detergent/sanitizer treatment, respectively. EO water is not only as effective as current practices, but also is more economical and eliminates storage of conventionally used dangerous chemicals.

Findings from this project will not only help reduce and control pathogenic microorganisms but will also benefit farmers, food processors, trade associations, and most importantly the consumer as the end user.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from Pennsylvania Department of Agriculture.

Scope of Impact: State Specific

Planned Program: Mycotoxins in Cereal Grains (PEN03808)

Key Themes: Biotechnology, Bioterrorism, Food Safety, Improved Pest Control and Food Quality and Protection Act Implementation

Brief Description: Mycotoxin contamination of food and feed grains is a serious economic problem for grain producers and processors in the United States because grain contamination impacts markets. This program contributes to a multistate project by defining the biosynthesis of Furasic Acid, the Fusarium mycotoxin that occurs in cereal grains. This toxin may affect plant health and synergizes the negative animal health effects of other co-occurring mycotoxins. The research examines the role of furasic acid in allowing the fungus to colonize the plant.

Impact/Accomplishment Statement: Data collection for studies on Fusarium ear rot and mycotoxin accumulation in Bt corn and near isolines were completed. The study was conducted at four field locations in Pennsylvania and Maryland in 2001 and 2002. Incidence of Fusarium ear rot was calculated based on number of infected plants and severity was determined as number of kernels with visible symptoms per infected ear. Relationships between ear rot incidence, ear rot severity, and mycotoxin level were statistically. There was a significant difference in incidence of ear rot caused by Fusarium fungi between the Bt and isoline hybrids with isolines having a higher incidence, but there was no statistical difference between the two hybrid types for ear rot severity. Corn grain samples were collected from as many sites as possible each year to conduct a mycotoxin analysis. A combined sample of kernels from twenty ears from the four replications was collected for each Bt and non-Bt isoline grown at each location. This material was ground in a Romer mill and sub-sampled for extraction and chromatographic analysis. Two independent extractions and chromatographic determinations were done for each sample for each mycotoxin. Fumonisins B1 and B2 were determined by high performance liquid chromatography (HPLC) following published methods. The limit of detection of this method is <0.1 ppm in our laboratory. No significant differences in fumonisin levels were observed between Bt and isolines but overall fumonisin levels were low and would not be a threat to livestock or humans. This study will contribute to an

overall assessment of the value Bt corn to farmers in the Northeast. Research done by collaborators on yield and insect pressure will be combined with quality information on mycotoxins and ear rot for a comprehensive look at the value of this technology. This information is anticipated to be informative for Northeastern grain corn producers regarding choices in purchase of seed.

Sources of Funding: Hatch Act, Multistate Hatch Act, and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from L. F. Lambert Spawn Company and Pennsylvania Department of Agriculture.

Scope of Impact: Multistate and International Research – GA, IL, IN, IA, KS, MI, MN, MO, NE, ND, PA, WI and Canada.

Goal 3
A healthy, well-nourished population.

Through research and education on nutrition and development of more nutritious foods, enable people to make health promoting choices.

Executive Summary: The Pennsylvania Agricultural Experiment Station engages in a variety of projects that contribute to a healthy, well-nourished citizenry. During FY2003, 17 projects supported Goal 3 themes. The two planned programs featured below illustrate accomplishments and impacts within this Goal. Additional highlights include development of peer-advising programs designed to increase awareness of tobacco, alcohol, and drug use in middle school teens. These programs have been adopted by at least twenty school districts in the state as a result of pilot testing (see more details in Multidisiplinary Activites section). Biotechnology has been promoted as one avenue to future health advantages to human populations, and a research project that is part of a multistate research effort has examined the source of technical information in media coverage of this subject. Results of this research reveal that the public may not be receiving complete coverage of the topic, which could influence their opinions, and, thus, acceptance, of these tools. This suggests research opportunities on how to communicate risk to the public around agriculture and health issues.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 3 were approximately $152,500 in FY2003, an increase of 4.2 percent over the FY2002 level of $146,300. Overall expenditures tracking to Goal 3 projects were also higher ($1.7 million in FY2003, up 5.9 percent from FY2002). State appropriated expenditures and external grant expenditures increased during FY2002. No new faculty hired during FY2003 would be characterized as having proposed research activities within Goal 3 themes. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 14 graduate students can be expected to be working on research projects consistent with Goal 3 themes.

Many of these research results are communicated to stakeholders through a variety of methods, but we continue to rely on the close connection between Experiment Station-sponsored research and the Penn State Cooperative Extension Service. Goal 3 outputs can be directly referenced in Penn State Cooperative Extension's Annual Report of Accomplishments and Results. Further accomplishments and outputs, including publications, can be found in by searching Pennsylvania projects in CRIS at http://cris.csrees.usda.gov/menu.html. Pennsylvania researchers also rely on traditional means of disseminating information, including publication in technical, popular, and trade outlets, presentations to stakeholders and policymakers, and web-based delivery methods. Our research results reach audiences in Pennsylvania, the nation, and the world.

No multistate projects during FY2002 would be characterized as having proposed research activities within Goal 3 themes.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
7.2	11.5	0.0	4.7	23.4

Total Expenditures directed to Goal ($ in thousands): [1]

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$153	$0	$0	$0	$480	$1,102	$1,735

The following agencies/sponsors provided leveraging dollars:

Center for Rural Pennsylvania
GlaxoSmithKline
National Institutes of Health
National Pork Board
National Pork Producers Council
National Starch and Chemical Company
Pennsylvania Department of Agriculture
Pennsylvania Department of Health
United States Department of Agriculture
United States Department of Defense
United States Department of Interior
University of Chicago

Planned Program: Assuring Palatability of Low-Fat Meat Products (PEN03703)

Key Themes: Food Quality, Human Nutrition, Modifying Food Intake Behavior, Multicultural and Diversity Issues

Brief Description: As part of a larger research effort to promote local production and preservation of animal source foods (ASF) in the diets of undernourished children in sub Saharan Africa, this program conducted a study to validate the food safety of a product called "Chiparoo." A Chiparoo is a comminuted rabbit and sweet potato dehydrated snack chip manufactured using a process suitable for underdeveloped regions of the world. The Chiparoo process was created with a NutriBusiness model in mind to create a product that could fit into a community based production and manufacturing cooperative, making more meat available for children of the community and a commercial product to sell.

Impact/Accomplishment Statement: A study was conducted to evaluate the ability of the Chiparoo manufacturing process to adequately deliver five log reductions in *Listeria monocytogenes*, *Escherichia coli O157:H7, Salmonella typhimurium,* and *Staphylococcus aureus* per gram of food product. The four pathogens were inoculated into regular (pH~6.0) and lime-juice-added (pH~5.0) formulations of rabbit and sweet potato Chiparoos as a cocktail of four microorganisms at concentrations of approximately 10^6/g of each pathogen. Individual inoculations of each pathogen at the same concentration (10^6/g) were also prepared. After inoculation, the product was held for five hours at 37°C, to simulate the maximum hold time in a sub-Saharan Africa manufacturing facility, then dehydrated at 55°C (+/- 5°C) for nine hours. Samples of the product were taken during the hold and dehydration steps, decimally diluted and plated on the appropriate enumeration medium. The regular formulation (pH~6.0) did not achieve the required five log reduction of each of the four pathogens, while the lime-juice-added formulation (pH~5.0) achieved the desired minimum five log reduction for each of the four foodborne pathogens tested. The products were evaluated by Kenyan mothers and children and found to have acceptable palatability. This food safety process study contributed to increasing the inclusion of animal source foods in diets of undernourished children in underdeveloped regions of the world, a food source that improves physical and cognitive development.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from National Pork Board and National Starch and Chemical Company.

Scope of Impact: State Specific and International Research – Sub-Saharan Africa, especially Kenya.

Planned Program: Agricultural Safety and Health for Farm Families and Farm Workers (PEN03874)

Key Themes: Farm Safety, Workforce Safety, Youth Farm Safety

Brief Description: Agriculture has been ranked by the National Safety Council as one of the most hazardous industries in the United States with a work death rate of nearly six times that of the all-industry average, costing the nation an estimated $980,000 in direct costs for each unintentional work-related death. This project is a continuation of previous research with the goal to develop methods and procedures to more accurately assess and classify farm and agricultural injury events and to develop new materials and procedures for educating adults and youth in work safety on the farm.

Impact/Accomplishment Statement: Analysis of fatal injury statistics among Pennsylvania residents involved in farm work and work environment incidents continued in 2003 with twenty fatalities recorded statewide during 2002. The data demonstrated that Pennsylvania injuries were reduced 41 percent from 2001 to 2002 (34 to 20), the single greatest annual drop in fatalities since 1980. When the direct cost of national estimates of a work-related death is applied to Pennsylvania farm fatality data, nearly $14 million dollars are saved due to the reduction in fatalities. Experimental evaluation of the youth version of the Agricultural Safety and Health Best Management Practices was completed and data turned over to the National Safety Council. Curriculum materials for the Hazardous Occupations Safety Training in Agriculture project were completed and the recruitment nation-wide for one hundred Master Trainers began.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from National Institutes of Health and Pennsylvania Department of Health.

Scope of Impact: State Specific Integrated Research and Extension

Goal 4

An agricultural system which protects natural resources and the environment.

Enhance the quality of the environment through better understanding of and building on agriculture's and forestry's complex links with soil, water, air, and biotic resources.

Executive Summary: The Pennsylvania Agricultural Experiment Station supports a variety of projects that contribute to protection of natural resources and the environment. In fact, most of our experiment station projects have elements of natural resource and environmental impacts. During FY2003, 94 projects specifically supported Goal 4 themes. The three planned programs featured below illustrate accomplishments and impacts within this Goal. The College of Agricultural Sciences has been responsible for in excess of 50 percent of all environment-related research conducted at Penn State in each of the past four years. Additional highlights include the evaluation of constructed wetlands for treating domestic waste from a conference center. This system is successful at handling organic wastes, especially in reducing nitrogen run-off. Wetlands constructed in greenhouse systems can be effective in cleaning greenhouse wastewater to EPA drinking water nitrate standards. Similar constructed wetland systems can mitigate odor issues associated with swine production. Data collected in a planned research project associated with NRSP-3, the National Atmospheric Deposition Program continue to provide long-term baselines for evaluating the Clean Air Act Amendments of 1990. Data show that nitrogen retention in forested ecosystems is high, which is important for protection of downstream watersheds, particularly the Chesapeake Bay system. Work on the importance of different forest ecosystems to migrating songbirds has demonstrated the value of suburban woodlots and forest edges as food sources during the

migration period. These results will help us balance preservation of intact forest critical for breeding sites with habitat necessary at other times during songbird life cycles.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 4 were approximately $1.24 million in FY2003, an increase of approximately 16 percent over the FY2002 level of $1.07 million. Overall expenditures tracking to Goal 4 projects were lower ($9.6 million in FY2003, down 4.4 percent from FY2002). State appropriated expenditures decreased approximately 25.7 percent while external grant expenditures increased approximately 12.9 percent during FY2003. Three new faculty hired during FY2003 would be characterized as having a portion of their proposed research activities within Goal 4 themes. These faculty will contribute to research in natural resource economics, environment-friendly crop production practices, and sustainable forest product production. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 84 graduate students can be expected to be working on research projects consistent with Goal 4 themes.

Many of these research results are communicated to stakeholders through a variety of methods, but we continue to rely on the close connection between Experiment Station-sponsored research and the Penn State Cooperative Extension Service. Goal 4 outputs can be directly referenced in Penn State Cooperative Extension's Annual Report of Accomplishments and Results. Further accomplishments and outputs, including publications, can be found in by searching Pennsylvania projects in CRIS at http://cris.csrees.usda.gov/menu.html. Pennsylvania researchers also rely on traditional means of disseminating information, including publication in technical, popular, and trade outlets, presentations to stakeholders and policymakers, and web-based delivery methods. Our research results reach audiences in Pennsylvania, the nation, and the world.

Multistate projects are an important part of our activity under Goal 4 themes. Eleven of our experiment station projects contribute to multistate projects within Goal 4 (NE-0171, NE-0187, NE-0503, NE-1001, NE-1013, NRSP-0003, S-0290, S-0301, W-0170, W-1133, W-0195). Individual impact statements are available to 'guests' on the web at National Information Management and Support Systems at http://www.lgu.umd.edu/login.cfm.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
43.6	76.7	8.6	36.0	164.8

Total Expenditures directed to Goal ($ in thousands): [1]

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$930	$315	$66	$0	$4,503	$3,803	$9,617

The following agencies/sponsors provided leveraging dollars:

American Egg Board
Arnold and Mabel Beckman Foundation
Centre for Rural Pennsylvania
Centre County Government
Cornell University
David and Lucile Packard Foundation
E. I. Dupont de Nemours and Company Inc.
Environmental Protection Agency
Golf Course Superintendents Association of America Foundation
Jem Co. Ltd.
National Audubon Society
National Institutes of Health
National Science Foundation
New York Wine and Grape Foundation
PennFuture
Pennsylvania Department of Agriculture
Pennsylvania Department of Conservation and Natural Resources
Pennsylvania Department of Environmental Protection
Pennsylvania Department of Transportation
Pennsylvania Fish and Boat Commission
Pennsylvania Game Commission
Pennsylvania Soybean Promotion Board
Pioneer Hi-Bred International Inc.
United States Civilian Research and Development Foundation for the Independent States of the Former Soviet Union
United States Department of Agriculture

United States Department of Defense
United States Department of Interior
United States Poultry and Egg Associations
University of California – American Vineyard Foundation
Washington Tree Fruit Research Commission

Planned Program: Anionic Clays: Potential Ion-Exchange Fertilizers (PEN03651)

Key Themes: Nutrient Management, Soil Quality

Brief Description: The contamination of ground water with nitrate is a major environmental problem in Pennsylvania raising many concerns about the ill effects on human health (e.g. the Blue Baby Syndrome, in which a baby's red blood cells do not carry enough oxygen). If nitrogen fertilizer were added as ammonium nitrate salt, it can be leached into ground water systems. When the nitrate is incorporated in a physically or chemically encapsulated form, the leaching of nitrate can be substantially reduced. Such encapsulation leads to the so-called "slow-release" fertilizers. We have tested anionic clays with nitrate anions, which are electrostatically bonded in the interlayers as slow-release ion exchange fertilizers. This planned program research proposes to alleviate the problem of nitrogen fertilizer loss from agricultural soils, greenhouse potted plants, and turf by testing nitrate-containing anionic clays for their suitability as slow release N-fertilizers.

Impact/Accomplishment Statement: A new and simplified method was developed for the synthesis of nitrate-containing anionic clay samples. This simplified method is essential for commercial production of these slow-release fertilizers. Several nitrate-containing anionic clay samples were synthesized and compared for crystallinity and/or particle size and equilibrated with a simulated soil solution to determine the kinetics of nitrate release. The release of nitrate from anionic clays was determined to be an interplay among the type of anions present in soil solution, their concentration, pH of soil solution, the charge density, and crystal size of anionic clay etc. Results showed that larger particle size samples were better for slow release of nitrate. By optimizing the crystal size and by granulating the material, slow-release nitrate fertilizers with about five percent N can be developed. These scientific findings could be used to develop slow-release nitrate fertilizers to alleviate the pollution of ground water with nitrate. These anionic clays can also be tailored to supply micronutrients slowly along with nitrate.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from National Science Foundation.

Scope of Impact: State Specific

Planned Program: Utilization of Spent Mushroom and Other Composts as Amendments for Greenhouse and Nursery Media (PEN03662)

Key Themes: Adding Value to New and Old Agricultural Products, Agricultural Waste Management, New Uses for Agricultural Products, Nutrient Management, Ornamental/Green Agriculture

Brief Description: Spent Mushroom Compost (SMC), also called Spent Mushroom Substrate (SMS), is a waste product generated from the production of mushrooms. Pennsylvania, the top-ranking mushroom growing state in the nation, generates an enormous amount of SMC, a soil-like material that is high in organic matter, making it desirable for use as a soil amendment for greenhouse and nursery media. However, this material is also very high in soluble salts, which can harm crops. To reduce the salt content, mushrooms growers have been applying the compost to the land and let it weather for one to two years by rainfall before they sell it to growers. The leaching

process causes odors and nutrient runoff problems. This research program evaluates the possibility of using fresh SMC directly as container media in the greenhouse and nursery industries rather than waiting for the weathering process.

Impact/Accomplishment Statement: Field and greenhouse trials of several plant genera were conducted to develop procedures for using SMC in container media directly without waiting for the leaching by weather process. Plants were grown in five different SMC mixtures and examined for bulk density, aerated pore space, container capacity, and saturated-salt leaching characteristics (as well as total salt content and pH). Results demonstrated that SMC could be used as a growing media for selected ornamentals, like marigolds, that were not sensitive to high salts and did not require low pH. Other trial result demonstrations determined that the source of SMC used had little effect on final plant growth quality, allowing greenhouse and nursery producers to use the SMC from more than one source and still grow a uniform crop of bedding plants. The research also determined that nutrients and salts could be leached from SMC in greenhouse in relation to the amount of water applied. The resulting product called the leachate containing beneficial nutrients for plant growth could, if diluted to specific amounts, be used by the greenhouse industry as a fertilizer for crop production. The research in this planned program has an impact on two major industries in Pennsylvania. Mushroom growers would be able to dispose of the SMS much faster, keeping it out of the waste stream or reducing land applications. The research also impacts the greenhouse/nursery industry, who currently obtain growing media from greater distances at higher costs. The industry's use of the nutrient-rich leachate as one of the components of a fertilization program costs less than commercial fertilizers and is an environmentally friendly way of disposing of a potential nutrient pollutant.

Sources of Funding: Hatch Act and State appropriated funds.

Scope of Impact: State Specific Integrated Research and Extension

Planned Program: Artificial Intelligence-Based Modeling of Natural and Managed Systems (PEN03814)

Key Themes: Forest Resource Management, Information Technologies, Land Use, Risk Management, Wildlife Management

Brief Description: The study of landscape ecology is a response to the need to understand the development and dynamics of pattern in ecological phenomena, the role of disturbance in ecosystems, characteristic spatial and temporal scales of ecological events, and interactions among multiple ecosystems. One of the principal technologies available for studying landscape ecology and management is the geographic information system (GIS). One objective of this research is to implement an intelligent database management/GIS system to assist in federal and state government service agencies in the storage, retrieval, and the interpretation of natural resource information.

Impact/Accomplishment Statement: The software based modeling approaches developed in support of this project were used throughout the United States Forest Service (ca. 50 NetWeaver/GeoNetWeaver licenses), the United States Department of the Interior National Park Service (Synthesis is presently installed in ca. 200 National Park Service offices), and internationally by the United States Agency for International Development (4 NetWeaver/GeoNetWeaver licenses to the Washington Offices, 9 licenses to the University of Botswana, and ca. 30 licenses distributed via software training sessions conducted in Africa). These computer-based systems capture, formalize, and represent qualitative and quantitative knowledge associated with managed and natural systems and have been incorporated into the Ecosystem Management Decision System (EMDS) (ca. 200 NetWeaver licenses) developed by the United States Forest Service and in many units in North America that presently use EMDS for the development of natural resource management models. In addition, the Redlands

Institute, the National Oceanic and Aeronautic Administration, the National Center for Ecological Analysis and Synthesis, and Union Camp Corporation are using our technology.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from E.I. Dupont de Nemours and Company Inc., United States Department of Agriculture, and United States Department of Interior.

Scope of Impact: Multistate and International Research – nationwide through National Park Services and United States Forest Service, sub-Saharan Africa

Goal 5
Enhanced economic opportunity and quality of life for Americans.

Empower people and communities, through research-based information and education, to address economic and social changes facing our youth, families, and communities.

Executive Summary: The Pennsylvania Agricultural Experiment Station supports a variety of projects that contribute to enhanced economic opportunity and quality of life. During FY2003, 48 projects supported Goal 5 themes. The two planned programs featured below illustrate accomplishments and impacts within this Goal. Additional highlights include research on intergenerational programming alternatives that link senior citizens with local youth. Changes in the workforce make senior volunteers in schools and other youth organizations an important alternative. This research is defining the types of services that seniors can offer, and the results are being disseminated through Cooperative Extension to personnel who develop new programs. Other research on the impact of 4-H experiences on young people has focused on identifying factors that will increase retention in the programs and completion of activities. Initial research reveals many positive outcomes in self-awareness, confidence, and attributes such as public speaking and decision-making. Continued emphasis on leadership development (for adult leaders and older youth) is warranted. Survey-based research on the relative importance of current issues in rural and urban communities provides data useful to decision-makers. Rural respondents were much more concerned about availability of jobs, but were equally concerned about issues such as crime and violence, health care, safe drinking water, and other topics. This research revealed significant effects of age, education, income, and gender on responses. Results are disseminated to Cooperative Extension and to state and local decision-makers.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 5 were approximately $381,300 in FY2003, lower than the FY2002 level of $391,900. Overall expenditures tracking to Goal 5 projects were higher (approximately $3.6 million in FY2003, up from $3.2 million in FY2002). State appropriated expenditures decreased approximately 29.5 percent while external grant expenditures increased by approximately 55.2 percent during FY 2003. Three new faculty hired during FY2003 would be characterized as having proposed research activities primarily within Goal 5 themes. One of these faculty members will also be partially supporting Goal 4 themes. These faculty will contribute to youth development and service learning opportunities and to rural economic development. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 37 graduate students can be expected to be working on research projects consistent with Goal 5 themes.

Many of these research results are communicated to stakeholders through a variety of methods, but we continue to rely on the close connection between Experiment Station-sponsored research and the Penn State Cooperative Extension Service. Goal 5 outputs can be directly referenced in Penn State Cooperative Extension's Annual Report of Accomplishments and Results. Further accomplishments and outputs, including publications, can be found in by searching Pennsylvania projects in CRIS at http://cris.csrees.usda.gov/menu.html. Pennsylvania

researchers also rely on traditional means of disseminating information, including publication in technical, popular, and trade outlets, presentations to stakeholders and policymakers, and web-based delivery methods. Our research results reach audiences in Pennsylvania, the nation, and the world.

Multistate projects are an important part of our activity under Goal 5 themes. Four of our experiment station projects contribute to multistate projects within Goal 5 (NC-0221, NC-1001, NC-1002, NE-1011). Individual impact statements are available to 'guests' on the web at National Information Management and Support Systems at http://www.lgu.umd.edu/login.cfm.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
19.2	20.0	0.0	11.9	51.2

Total Expenditures directed to Goal ($ in thousands): [1]

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$313	$68	$17	$0	$1,738	$1,555	$3,691

The following agencies/sponsors provided leveraging dollars:

American Sociological Association
Center for Rural Pennsylvania
Environmental Protection Agency
Kane Chamber of Commerce
National Audubon Society
National Institutes of Health
National Science Foundation
PennFuture
Pennsylvania Department of Agriculture
Pennsylvania Department of Conservation and Natural Resources
Pennsylvania Department of Energy
Pennsylvania Department of Environmental Protection
Pennsylvania Department of Health
Pennsylvania Department of Transportation
Pennsylvania Fish and Boat Commission
Pennsylvania Game Commission
United States Department of Agriculture
United States Department of Interior

Planned Program: An Economic Policy Simulation Model for Pennsylvania (PEN03678)

Key Themes: Agricultural Competitiveness, Community Development, Impact of Change and Rural Communities, Information Technologies, Jobs/Employment, Land Use

Brief Description: In today's complex and volatile economic climate, local policy and decision-makers must understand the structure of their economy in order to fully understand the effects of economic events. Unfortunately, most communities lack the resources to adequately examine the consequences of an economic event and as a result, important decisions are made with limited information and subsequently limited understanding. The research of this project has furthered an understanding of local economic structure in which decision-makers craft development policy in order to provide Pennsylvania counties with a tool useful to development practitioners for policy and impact analysis.

Impact/Accomplishment Statement: The project has had substantial impacts in Pennsylvania. Using the results of the research, a Penn State economic policy simulation model was constructed that has helped communities better understand the potential impacts of change. The model named the Community Impact Model (CIM-PSU) is available on line at http://cimpsu.aers.psu.edu for each Pennsylvania county. It is used to predict how economic change can affect communities by providing information on a number of important economic indicators, including employment and unemployment, income, population, government expenditures and revenues, and school district expenditures and revenues. The CIM-PSU model is integrated into an extension

program and has been used widely across the state. For example, it has been used to assess the role of the Allegheny National Forest in the regional economy; to analyze the impact of Plum Pox Virus in Adams County; and the impact of the closing of the Crandon mine. With this information, local policymakers have been able to access state and federal assistance for dealing with change.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from Center for Rural Pennsylvania.

Scope of Impact: State Specific Integrated Research and Extension

Planned Program: Consumer Valuation of Food Quality Attributes (PEN03872)

Key Themes: Biotechnology, Consumer Management, Integrated Pest Management

Brief Description: While current biotechnology applications can provide benefits to agricultural producers, uncertainty about consumer's acceptance can decrease those benefits. The focus of this planned program research is on consumer acceptance of foods derived using modern biotechnology.

Impact/Accomplishment Statement: Work completed and in progress in this research project investigates consumer attitudes toward and the willingness to purchase foods produced using biotechnology. Three methods were used to measure consumer acceptance in order to determine whether results depend on how data were collected. One method consisted of a market experiment where biotech and conventional sweet corn was grown, labeled, and sold side-by-side in nine participating stores in the large urban area of Philadelphia. A brochure was provided to consumers with information about the differences between the two types of corn and consumers who purchased either type of corn were surveyed on-site. Survey questions included awareness and knowledge of biotechnology, attitudes toward it, and trust in grocery stores and government to tell the truth about biotechnology. The market experiment was complemented with a telephone survey conducted in the same areas during the same period of time and experimental auctions conducted at four of the participating stores. The results should be of use to growers considering adopting biotech crop varieties and to food manufacturers and retailers considering labeling biotech products, and to policymakers.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from United States Department of Agriculture.

Scope of Impact: State Specific Integrated Research and Extension

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Stakeholder Input Process: We continue to rely upon the close interactions between the Agricultural Experiment Station and Cooperative Extension as a primary source of stakeholder input. Approximately one half of the faculty, staff, and administrators on the University Park campus supported by research funding have split appointments in research and extension. These connections help to ensure that our research enterprise is informed by the needs of end users of our knowledge generation. Details of the Cooperative Extension processes for stakeholder listening are available in the Penn State Cooperative Extension FY2000-04 Plan of Work and the Penn State Cooperative Extension Annual Report of Accomplishments and Results FY2000, FY2001, FY2002 and FY2003.

Representatives of the Pennsylvania Agricultural Experiment Station also interact directly with stakeholders, providing them with the opportunity to comment directly on research priorities. The Pennsylvania Agricultural Experiment Station Research Plan of Work FY2000-04 provides a list of stakeholder groups and events that provide such feedback. Examples within FY2003 include state-wide or regional meetings of the Pennsylvania Farm Bureau, PennAg Industries, the State Horticultural Association of Pennsylvania, the Pennsylvania Agronomic Education Society, the Pennsylvania Association for Sustainable Agriculture, the Pennsylvania Christmas Tree Growers Association, and the Center for Rural Pennsylvania, among many others. We also have direct connections with the Penn State Agricultural Council (http://agcouncil.cas.psu.edu) and, through the council, the 95 member organizations and groups representing the agricultural industry across Pennsylvania. Our discussions with stakeholders have influenced budget priorities, with regards to both faculty/staff positions and program funds, and the strategic planning process.

Stakeholders continued to provide input in identifying emerging issues that require new or innovative research. For example, our stakeholders (industry and the public) continue to identify the need to develop new and cost-effective antimicrobial delivery systems and novel intervention strategies to eliminate and control pathogenic and spoilage microorganisms during food processing and storage (PEN03783) to prevent outbreaks of foodborne illness and improve the quality of foods. Results of this research are validated under laboratory conditions and findings are applied in curricula development for stakeholders' short courses and workshops series, benefiting farmers, food processors, trade associations, and most importantly the consumer as the end user. Research conducted to identify mycotoxins in cereal grains (PEN03808) have gained great importance for our governmental agency stakeholders because some of the toxins are on the list of United States select agents. The ability to develop rapid detection systems that will identify isolates to species has important bio-defense applications in addition to ensuring livestock and human health.

Program Review Process: There have been no significant changes in the Merit and Peer Review processes during FY2003 as stated in the Research Plan of Work for the Pennsylvania Agricultural Experiment Station for Federal Fiscal Years 2000 to 2004.

Evaluation of the Success of Multi and Joint Activities:

Multistate Activities: Collaborative research is an important mechanism for expanding the capacity of our Agricultural Experiment Station researchers. Our faculty participated in 44 multistate projects in FY2003. In addition, Penn State researchers regularly engage in collaborative efforts with research colleagues in other states, primarily through the process of obtaining external funding leveraged by Hatch Funds. Several USDA Competitive Grants programs have placed an emphasis on such collaborative research, and our faculty have responded enthusiastically to these opportunities. Many of these efforts are regional in nature, reflecting shared agricultural research priorities, but a number of the collaborations are national and international.

Integrated Activities: The Pennsylvania Agricultural Experiment Station has a commitment to working with Penn State Cooperative Extension and Resident Education to fully integrate the research enterprise with other functions within the College of Agricultural Sciences and the University. Nearly all of our faculty have joint appointments that cross the research, cooperative extension, and resident education functions, and this is reflected in our nine new faculty added to the Experiment Station in FY2003. This integration of appointment helps to ensure that all clientele receive the benefit of the latest research information generated here at Penn State and beyond.

Multidisciplinary Activities: Nearly all of the research activities conducted by the Pennsylvania Agricultural Experiment Station are multidisciplinary in nature. In FY2003 the College of Agricultural Sciences, of which the Experiment Station is the research enterprise, contributed to Social Sciences research, Life Sciences research, research in the Children, Youth, and Families Consortium, and to Environmental research, all of which are university-wide multidisciplinary initiatives.

The planned multi and joint activities conducted by the Pennsylvania Agricultural Experiment Station addressed issues that have been identified through the multistate activities planning process (multistate projects) and

through needs assessments in collaboration with cooperative extension and/or resident education faculty and audiences. The relevance of these activities to the five USDA goals has been noted in the previous sections. In addition, multi and joint activities are conducted in the framework of the College of Agricultural Sciences three-year strategic plan, which identifies areas of critical issues (http://www.cas.psu.edu/2002StrategicPlan.pdf) at the state level. The College strategic priorities determine our faculty hires and program fund allocations for each of these issue areas and faculty develop their Hatch and multistate projects on the basis of these critical issues.

One of the criteria for our research funding continued to be the relevance of our planned programs to underserved and underrepresented populations. In 2003, we provided funding to faculty who addressed the socioeconomic factors influencing youth at risk to gather information in a scientific manner about perception of youth in terms of their needs from their communities. Project ALERT (PEN03806), a middle-school program designed to examine teen perceptions about the use of alcohol, tobacco, and other drugs, was delivered in eight new schools. A total of twenty school districts in Pennsylvania have now adopted this program following pilot activities. Research on effectiveness of adult versus peer leadership is in progress. As part of a larger and global research effort to promote local production and preservation of animal source foods in diets of undernourished children in South Africa, our planned program PEN03703 developed a new product and conducted studies to validate the food safety of the product. The product, evaluated by Kenyan mothers and children, was found to have acceptable palatability and can increase the inclusion of animal source foods in diets of undernourished children in underdeveloped regions of the world, improving physical and cognitive development. Furthermore, all our faculty are regularly made aware of the need to engage in projects that provide research results with meaningful impact to all of our audiences.

All of our planned programs list expected outcomes or impacts of the research, and our multi and joint activities are no exception to this. Research activities funded via competitive grants are generally required to include outcomes and impacts as part of the application process. The evaluation of these proposals routinely includes consideration of the relevance of the research as measured by these expected outcomes.

Joint and multi-activity planned programs report annually on impact, which measures program effectiveness. Project PEN03678, An Economic Policy Simulation Model for Pennsylvania Counties, which is reported in Goal 5 of this report, serves as an illustration of these measures. The development of an economic policy simulation model (CIM-PSU http://cimpsu.aers.psu.edu) is allowing local policy and decision-makers to better understand the effects of economic events on the structure of a local economy. The CIM-PSU model is integrated into an extension program and widely used across the state. It has been used to assess the role of the Allegheny Forest in the regional economy, to analyze the impact that the Plum Pox Virus has had in Adams County, Pennsylvania, and also to examine the local social and economic characteristics that influence the location of growth of high-tech businesses. The information generated from the analysis are being used by the Central Pennsylvania Workforce Development Corporation, a group that is identifying and developing industry clusters in central Pennsylvania, and by local policymakers to access state and federal assistance for dealing with local economic changes.

Integrated Research and Extension Activities: Of the 560 administrators, faculty, and staff at University Park who are supported with research funds, 262 have split research and extension appointments. Funds supporting this research portion of these positions account for the appropriated dollars indicated on the first line on Form CSREES-REPT (see Appendix A). The dollars indicated on this line are the result of personnel with a research and extension joint appointment, where the research portion is paid on Hatch or Multistate Hatch funds.

[1]The resources indicated in this document are based on FY2003 expenditures and do not include fringe benefits or University overhead.

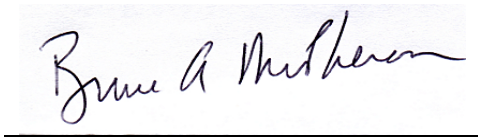
U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution: PA Agricultural Experiment Station
State: Pennsylvania

Check one: ____ **Multistate Extension Activities**
X **Integrated Activities (Hatch Act Funds)**
____ **Integrated Activities (Smith-Lever Act Funds)**

Actual Expenditures

Title of Planned Program/Activity	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Joint Research and Extension Personnel Appointments	$1,511,058	$1,509,013	$1,456,953	$1,623,063	
Fruit Research and Extension Center			$11,281		
Lake Erie Regional Grape Research and Extension Center			$7,000		
Southeast Agricultural Research and Extension Center			$1,000		
Total	$1,511,058	$1,509,013	$1,476,234	$1,623,063	



29 Mar 2004

Bruce A. McPheron, Director
PA Agricultural Experiment Station

Date

Form CSREES-REPT (2/00)

Appendix A