

ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

for the
Pennsylvania Agricultural
Experiment Station
at
The Pennsylvania State University

PENNSSTATE



College of Agricultural Sciences

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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 FY2004, 223 projects supported Goal 1 themes. The two planned projects that are featured below illustrate accomplishments and impacts within this Goal. Additional highlights include projects focusing on resistance of food plants to enemies and abiotic stress. A project has identified the role of a particular gene, copine, in regulating two different pathogen response pathways in plants and has elucidated the mechanism by which the copine protein detects pathogenic bacteria. Another study demonstrated the role of ethylene in modulating plant root response to low available phosphorus; ethylene action is required to stimulate denser root hair production. Screening of a large collection of wild tomato germplasm revealed accessions with strong resistance to early and late blight. These accessions are being incorporated into breeding studies that have begun to reveal the inheritance of disease resistance, drought tolerance, and lycopene content in tomatoes. A comparative study conducted under another project is examining how a stress response pathway (leading to insecticidal and fungicidal natural compounds) is regulated in maize versus sorghum in order to find a better means of controlling plant responses. Our focus on sustainable and organic agriculture as another business model for Pennsylvania agriculture continues. Field plots have been established to examine apple production under organic management systems. This project has had extensive and important stakeholder participation from producers and processors. Another land block that has been undergoing transition to organic courtesy of USDA competitive funds is the impetus for a major stakeholder-driven process supported by Hatch funds to develop a vision for research activities in support of transition to organic and organic production. Weed management is a major barrier in the transition to organic, and we have multiple research projects examining alternatives to conventional pesticides. A key economic factor in dairy production systems lies in the health of cows transitioning from the dry period into lactation. Hatch funds supported study of dietary modifications to positively influence dry matter consumption and blood metabolite levels. One result of this modification could be reduced ketosis following calving, with a resultant potential for reduced postpartum diseases (postpartum diseases are estimated to cost dairy producers an average of \$600 per cow).

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 1 were approximately \$3.79 million in FY2004, an increase of 1.2 percent from the FY2003 level of \$3.75 million. Overall expenditures tracking to Goal 1 projects were slightly higher (\$38.4 million in FY2004, up nearly 3.4 percent from FY2003). State appropriated expenditures increased approximately 1.2 percent and external grant expenditures increased approximately 6.1 percent during FY2004. Two new faculty hired during FY2004 have a significant portion of their proposed research activities within Goal 1 themes. In addition, one faculty member will also be contributing to Goal 4. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 300 graduate students can be expected to be working on research projects consistent with Goal 1 themes.

Faculty hires relating to Goal 1 enhance our plant breeding capacity and strengthen our epidemiological prediction team.

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-0504, NC-1009, NC-1010, NC-1119, NC-1142, NE-0009, NE-0127, NE-0132, NE-0181, NE-0183, NE-0503, NE-1006, NE-1007, NE-1008, NE-1009, NE-1014, NE-1015, NE-1071, S-0289, S-0291, S-0294, S-1000, S-1008, W-0189, W-0195, W-0501). Individual impact statements are available on the web at the National Information Management and Support Systems at <http://nimss.umd.edu/>.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
176.5	305.8	33.2	76.0	591.5

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

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
\$3,080	\$714	\$414	\$54	\$16,562	\$17,566	\$38,389

The following agencies/sponsors provided leveraging dollars:

- | | |
|---|---|
| American Cancer Society | Max Kade Foundation Inc. |
| American Cocoa Research Institute | McKnight Foundation |
| American Egg Board | Monsanto Company |
| American Heart Association | National Association of Animal Breeders |
| American Meat Institute | National Audubon Society |
| American Mushroom Institute | National Commission on Science for Sustainable Forestry |
| Andersons Inc. | National Geographic Society |
| Andrew W. Mellon Foundation | National Honey Board |
| Arnold and Mabel Beckman Foundation | National Institutes of Health |
| Asilas Genomic Systems | National Pork Producers Council |
| BASF Corporation | National Science Foundation |
| Binational Agricultural Research and Development | New York Wine and Grape Foundation |
| Bio-Cide International, Inc. | Penn State's Office of Physical Plant |
| Cadbury Chocolate Canada Inc. | Pennsylvania Department of Agriculture |
| California Department of Food and Agriculture | Pennsylvania Department of Community and Economic Development |
| Center for Rural Pennsylvania | Pennsylvania Department of Conservation and Natural Resources |
| Cleary Chemical Corporation | Pennsylvania Department of Environmental Protection |
| Conservation Food and Health Foundation | Pennsylvania Department of Health |
| Cornell University | Pennsylvania Department of Transportation |
| Dairy Management Inc. | Pennsylvania Fish and Boat Commission |
| David and Lucile Packard Foundation | Pennsylvania Game Commission |
| EI Dupont De Nemours and Company | Pennsylvania Soybean Promotion Board |
| EIEICO Inc. | Pennsylvania Tobacco Settlement |
| Environmental Protection Agency | Pfizer - Warner Lambert |
| Farm Foundation | Public Health Service |
| Gerondelis Foundation Inc. | Seedway |
| GlaxoSmithKline | Spicam Agro USA Inc. |
| Golf Course Superintendents Association of America Foundation | Strategic Alliance Management Committee |
| Griffin LLC | Southwestern Pennsylvania Heritage Preservation Commission |
| Hershey Medical Center | Truss Plate Institute |
| Horticultural Research Institute | Udale, Richard W. |
| International Rice Research Institute | United States Agency for International Development |
| ISK Biosciences Corporation | |
| Jem Co. Ltd. | |
| Johnson and Johnson | |
| Kane Chamber of Commerce | |
| Leukemia and Lymphoma Society | |

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
University of California
Washington Tree Fruit Research Commission

Planned Program: Markets, Prices, and the Coordination of Economic Activity in the Food System (PEN03704)

Key Themes: Agricultural Competitiveness, Agricultural Profitability

Brief Description: Fourteen percent of trucks on the road have agricultural products in them and the transportation of such products has an impact on the costs of foods purchased by consumers. This research program looks at the effects of congestion on the agricultural and food economy and its impact on regional farm incomes and consumer goods.

Impact/Accomplishment Statement: A rural congestion study was conducted under this program as the first of its kind. Initial results, presented at a National Forum on Agriculture and Transportation Linkages in Fargo North Dakota, showed that rural congestion in the northeastern United States decreases regional farm incomes, transferring this revenue largely to farmers in other regions that face less rural congestion. This pressing issue is part of the current round of federal highway funding and the Transportation Forum was designed to focus debate. Data from this research should help more populated states get more access to rural transportation dollars and accordingly help farmers and rural residents by improving their transportation system, as well as help decrease consumer food expenses.

Sources of Funding: Hatch Act and State appropriated funds.

Scope of Impact: State Specific

Planned Program: Epidemiology of Blast (Gray Leaf Spot) of Perennial Ryegrass, and Biology of the Pathogen *Pyricularia grisea* (PEN03711)

Key Themes: Home Lawn and Gardening, Ornamental/Green Agriculture, Plant Health

Brief Description: Gray leaf spot (blast) disease of perennial grass is a serious problem for the turfgrass industry. In recent years, severe outbreaks of the disease have resulted in increased annual fungicide costs in the thousands of dollars on golf courses with perennial ryegrass fairways and some resorts have reported losses up to \$500,000 in revenues due to severe outbreaks of the disease. This research program conducted an epidemiological study to evaluate the effects of temperatures and leaf wetness duration on the development of gray leaf spot. The work also evaluates the application timing of ethofumesate, a herbicide used for annual bluegrass control, and its effects on gray leaf spot severity in order to explore alternative methods of integrated disease management strategy in the turfgrass industry.

Impact/Accomplishment Statement: The effects of temperature and leaf wetness duration on development of gray leaf spot were evaluated. Findings demonstrated that there were significant effects of both factors on disease incidence and severity, significant interactions between them, and that disease incidence and severity increased with increase in leaf wetness duration at all temperatures. The evaluation on timing of application of ethofumesate showed that application of the herbicide in the spring contributed to gray leaf spot epidemic development in summer; therefore, application of this herbicide

should be made in fall in golf courses with chronic gray leaf spot problem. Information generated from this research was instrumental in the development of an integrated disease management strategy in turfgrass industry.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from Andersons Inc., BASF Corporation, Cleary Chemical Corporation, E. I. Dupont De Nemours and Company, Griffin LLC, Golf Course Superintendents Association of America Foundation (GCSAA), ISK Biosciences Corporation, and Spicam Agro USA Inc.

Scope of Impact: State Specific

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 FY2004, 36 projects supported Goal 2 themes. The two planned programs featured below illustrate accomplishments and impacts within this Goal. Additional highlights include the evaluation of electrolyzed oxidizing water as a tool for Cleaning-in-Place of farm milking systems and for use in commercial egg washers as alternatives to other microbial control strategies. Multistate Hatch funds support the further development of “electronic nose” to detect damage in apples. Validation of this technology will provide industry with a means for rapid sorting of pathogen-infested apples before processing. Another project investigated the potential of pulsed ultraviolet light as an alternative to conventional pasteurization treatments. This new technique achieved complete inactivation of *Staphylococcus aureus* in several trials with both static and continuous flow parameters.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 2 were approximately \$223,838 in FY2004, a reduction of 22.6 percent over the FY2003 level of \$289,198. Overall expenditures tracking to Goal 2 projects were lower (\$2.67 million in FY2004, down 16.3 percent from FY2003). State appropriated expenditures decreased approximately 18.6 percent and external grant expenditures decreased approximately 14 percent during FY2004. No new faculty hired during FY2004 would be characterized as having proposed research activities within Goal 2 themes. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 30 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. Four of our experiment station projects contribute to multistate projects within Goal 2 (NC-0129, 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 on the web at the National Information Management and Support Systems at <http://nims.umd.edu/>.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
17.6	14.7	0.0	9.5	41.8

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

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
\$174	\$50	\$0	\$0	\$857	\$1,591	\$2,672

The following agencies/sponsors provided leveraging dollars:

- | | |
|--|---|
| Academy of Applied Science | National Honey Board |
| American Floral Endowment | National Institutes of Health |
| Binational Agricultural Research and Development | National Pork Producers Council |
| Bio-Cide International Inc. | National Science Foundation |
| Gerondelis Foundation Inc. | Pennsylvania Department of Agriculture |
| GlaxoSmithKline | United States Department of Agriculture |
| Horticultural Research Institute | United States Department of Defense |

Planned Program: Molecular Identification of Pathogenic *Fusarium* Species (PEN03738)

Key Themes: Food Safety, Foodborne Illnesses

Brief Description: *Fusarium* is one of the most important plant pathogenic fungal genera, causing a wide variety of diseases on many different hosts such as grains and greenhouse crops of importance to Pennsylvania agriculture. This program identified and characterized pathogenic and toxigenic fusaria using the tools of molecular systematics and developed accessible data to identify species infecting hosts.

Impact/Accomplishment Statement: A new species infecting *Hosta* in the U.S. and Europe, *F. hostae*, was discovered, and the species identity and diversity of fusaria causing diseases of *Lisianthus* and *Caladium* were characterized. This research program work also resulted in the first on-line accessible DNA sequence database for identifying *Fusarium*. The database has been updated to include 474 sequences since its initial release in 2003. This resource provides scientific users with the ability to make accurate identifications of toxic and pathogenic *Fusarium* isolates using simple and proven molecular methods and could also be used by regulators.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from Academy of Applied Science, American Floral Endowment, and National Science Foundation (NSF).

Scope of Impact: State Specific

Planned Program: Detection, Tracking, and Control of Foodborne Pathogens (PEN03952)

Key Themes: Food Handling, Food Safety, Foodborne Illnesses, Foodborne Pathogen Protection

Brief Description: Consumers are increasingly demanding foods that are fresh and/or minimally processed. As a result food processors have implemented many novel-minimum processing technologies to meet these demands. However, minimally processed foods often do not destroy all pathogens, leaving some cells in an injured state which can recover and grow in various foods and become virulent again. Also, pathogens may re-contaminate foods after pasteurization through various routes. The purpose of this research program is to develop methods that detect injured pathogens in foods and methods that can track pathogens in food processing plants, allowing the development of intervention strategies for their control.

Impact/Accomplishment Statement: A Multi-Virulence-Locus Sequence Typing (MVLST) method was developed to target six virulence genes in *Listeria monocytogenes*. This molecular subtyping method yielded higher discriminatory power than standard Pulsed-Field Gel Electrophoresis when twenty-eight selected strains of *L. monocytogenes* were analyzed. The MVLST method is currently being optimized to reduce time and cost of analysis while maintaining high discriminatory power. Studies are ongoing to develop a MSLT strategy for subtyping all *Listeria* species, which are used by many processors as indicators of the possible presence of *L. monocytogenes*. These new Multi-Locus Sequence Typing methods will help food processors track both *Listeria* species and *Listeria monocytogenes* in food processing plants and thus will allow them to implement effective intervention strategies that prevent contamination of Ready-to-Eat foods. The MVLST method concept could also be applied to trace the origin of a biological warfare agent for forensic purposes.

Sources of Funding: Hatch Act, Multistate 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

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 FY2004, 14 projects supported Goal 3 themes. The two planned programs featured below illustrate accomplishments and impacts within this Goal. Additional highlights include Hatch-supported funding of mouse models for obesity. The human health issues surrounding food are now well-documented. Characterization of a mouse model that displays morbid obesity and hypoglycemia can provide a system to identify underlying genetic factors contributing to obesity-induced metabolic issues in human populations. To date, more than 150 quantitative trait loci have been associated with mouse obesity using this model.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 3 were approximately \$95,576 in FY2004, a decrease of 37.3 percent over the FY2003 level of \$152,521. Overall expenditures tracking to Goal 3 projects were also lower (\$1.4 million in FY2004, down 16.6 percent from FY2003). State appropriated expenditures decreased approximately 15.7 percent and external grant expenditures decreased approximately 14

percent during FY2004. No new faculty hired during FY2004 would be characterized as having proposed research activities within Goal 3 themes. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 13 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 would be characterized as having proposed research activities within Goal 3 themes.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
7.5	7.6	0.0	2.0	17.0

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

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
\$96	\$0	\$0	\$0	\$405	\$947	\$1,448

The following agencies/sponsors provided leveraging dollars:

- | | |
|---------------------------------|---|
| Center for Rural Pennsylvania | Pennsylvania Department of Agriculture |
| Gerondelis Foundation Inc. | Pennsylvania Department of Health |
| GlaxoSmithKline | United States Department of Agriculture |
| National Institutes of Health | United States Department of Defense |
| National Pork Producers Council | United States Department of Interior |

Planned Program: Regulation of the Ah Receptor Signal Transduction Pathway (PEN03837)

Key Themes: Human Health, Scientific Basis for Optimal Health

Brief Description: Dioxin is a highly toxic and carcinogenic environmental contaminant that is widespread across the U.S. due to air pollution. The presence of this contaminant in the environment is a potential human and animal health concern that has received considerable attention. Most of the dioxin that humans are exposed to comes from the diet, with 90 percent of that coming from the consumption of meat and dairy products. This research program focuses on elucidating the mechanisms of toxicity of dioxin at the molecular level by determining the multiple mechanisms of regulation of the Aryl hydrocarbon (Ah) receptor, a receptor that mediates most of the toxic effects of dioxin.

Impact/Accomplishment Statement: Several studies are providing the information necessary to understand how the Ah receptor is activated by dioxin, leading to regulation of gene transcription. These studies will aid scientists in understanding the role of Ah receptor in normal cell physiology as well as during exposure to dioxin. Research findings will help evaluate whether the low level of dioxin exposure is a public health concern and data could be used by state and federal agencies in developing environmental protection guidelines.

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.

Scope of Impact: State Specific

Planned Program: Understanding the Influence of Intra Family Factors on Food Choices (PEN03962)

Key Themes: Human Health, Human Nutrition, Modifying Food Intake Behavior

Brief Description: Little research has been done on the intra family factors that influence risk judgments, specifically on individuals making food choices for their families (meals that are shared) that would include judgments of risk in that decision. This planned program research addresses the factors that influence risk perceptions around food choices in two situations, chronic disease prevention and disease treatment, to develop educational strategies and programs for at risk populations.

Impact/Accomplishment Statement: Activities under the disease prevention part of the research included eight cognitive interviews with low-income individuals who viewed one functional food intake lesson and one of the handouts and eight focus groups to learn how first and second generation Chinese Americans feel about eating currently available dairy products as a way to protect bone health. Low-income individuals who participated in the cognitive interviews learned about functional vegetables that reduce the risk of cancer. Chinese American participants learned about new dairy products that may appeal to them and improve their bone health. The disease treatment research continued its recruitment efforts for phase three of the diabetes couple study using: a) public service notices in local papers and bargain sheets; b) notices through our cooperative extension network; and c) visits with support groups throughout eastern Pennsylvania. Human subject approval was secured to advertise the study through the City of Philadelphia Health Department. In addition, the research funded a mailing of a letter of recruitment to patients in a medical practice at Hershey Medical School. By the end of December 2004 the program had recruited and administered instruments and 24-hour recalls to about 120 volunteers with type-2 diabetes. The volunteer participants in this diabetes couple study received a report on their 24-hour recalls and recommendations to help them comply with the Dietary Guidelines.

Sources of Funding: Hatch Act and State appropriated funds.

Scope of Impact: State Specific

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 FY2004, 98 projects specifically supported Goal 4 themes. The three planned programs featured below illustrate accomplishments and impacts within this Goal. Multistate Hatch funds are supporting work on on-farm ammonia emission from commercial poultry production facilities. Both odor and the health effects of air emissions have impinged upon agriculture in recent

years. A relatively inexpensive instrumentation system was developed to measure emissions, with initial data collection trying to quantify location- and time-specific variation in ammonia release. Development and implementation of emission abatement strategies will follow. Studies on the implications of sewage biosolid applications on agricultural productivity and environmental quality have been implemented to provide baseline information as states move toward a phosphorus index as a regulatory tool in nutrient management. Biosolids application rate and nature of the site's buffer strip were important factors in harmonizing biosolid use with P indices. This study continued to examine heavy metal accumulation issues. The use of geospatial analysis to map ecological landtypes in Pennsylvania has contributed to ecosystem management at the landscape level by the Pennsylvania Bureau of Forestry. Work on forest regeneration continued across 67 different parcels, with paired fenced and unfenced parcels providing direct evaluation of the impact of deer browsing and an opportunity to compare this mortality source to other potential factors, such as competition among plant species. Oak regeneration findings were communicated in workshops to the Pennsylvania Bureau of Forestry and USDA Forest Service.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 4 were approximately \$1.33 million in FY2004, an increase of approximately 7 percent over the FY2003 level of \$1.24 million. Overall expenditures tracking to Goal 4 projects were also higher (\$10.9 million in FY2004, up 12.97 percent from FY2003). State appropriated expenditures increased approximately 12.3 percent and external grant expenditures increased approximately 16.1 percent during FY2004. One new faculty hired during FY2004 would be characterized as having a portion of their proposed research activities within Goal 4 themes. This faculty member will also be partially supporting Goal 1 themes. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 89 graduate students can be expected to be working on research projects consistent with Goal 4 themes.

The new faculty member hired in FY04 brings a modeling expertise to agricultural systems such that environmental protection may be achieved through application of predictive tools to pest management.

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. Twelve of our experiment station projects contribute to multistate projects within Goal 4 (NE-0171, NE-0197, NE-0503, NE-1001, NE-1013, NE-1017, NRSP-0003, S-0290, S-0301, W-0170, W-0195, W-1133). Two of the featured planned projects below are multistate; project PEN03926 contributes to NE-1013 and project PEN03935 contributes to W-1133. Individual impact statements are available on the web at the National Information Management and Support Systems at <http://nims.umd.edu/>.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
53.9	89.8	12.9	30.5	187.1

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

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
\$938	\$397	\$55	\$0	\$5,058	\$4,418	\$10,865

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
Environmental Protection Agency
Golf Course Superintendents Association of America
Foundation
Horticultural Research Institute
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: Economic Evaluation of Water Resource Impacts from Projected Climate Change (PEN03795)

Key Themes: Biodiversity, Global Change and Climate Change, Land Use, Water Quality, Wetlands Restoration and Protection

Brief Description: Projected climate change is expected to pose significant threats to ecosystems and biodiversity, affecting fundamental ecological processes and the spatial distribution of terrestrial and aquatic species. The continued survival of species in question will depend critically on the availability of migration corridors and the existence or emergence of suitable habitats. Because land use can affect these opportunities, a crucial issue in facilitating ecosystem adaptation to climate change is managing land use and landscapes to preserve migration corridors and potentially emergent habitats. This research program developed models to examine the design of economically optimal strategies for protecting wetlands and Submerged Aquatic Vegetation (SAV).

Impact/Accomplishment Statement: Dynamic programming models were developed for examining the design of economically optimal strategies for protecting wetlands and SAV, taking into account future climate and land use change. Substantial losses of wetlands and SAV due to land development and other factors have had profound impacts on aquatic resources. Current conservation efforts fail to account for the impacts of climate change on sea level or land development. The models compute the optimal acquisition of sites for wetlands or SAV protection and/or restoration taking into account uncertainty about future sea level rise and land use change. The models are being demonstrated in the southern Chesapeake Bay. The most fundamental finding is that the return from investments in restoration and protection efforts will be much greater if designed in anticipation of climate and land use change rather than under the assumption of static climate and land use. This research contributed to the development of methodologies to guide public investments to protect ecosystems threatened by climate change.

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

Planned Program: Mechanisms of Plant Responses to Ozone in the Northeastern U.S. (PEN03926)

Key Themes: Air Quality, Global Change and Climate Change, Weather and Climate

Brief Description: Surface level (tropospheric) ozone continues to pose serious problems for the growth and productivity of agricultural crops across much of the eastern United States. As part of a multistate effort to understand the mechanisms of plant responses to ozone in the northeastern regions of the U.S., this program conducted research to determine the effects of ambient ozone on grape cultivar Chambourcin and on a variety that is considered ozone-tolerant in various growing situations.

Impact/Accomplishment Statement: The ozone exposure in 2004 compared to previous years (prior to 2003) at the Penn State Fruit Research and Extension Center in Biglerville, Adams County, Pennsylvania was very low due to cloudy and wet conditions during the weather patterns of the 2004 growing season. Maximum ozone exposures occurred during a July episode with 91ppb ozone being the highest hourly average. This and earlier episodes induced foliar symptoms, including stippling, yellowing, and defoliation of the older leaves of Chambourcin vines. These vines had been planted within open plots and non-filtered-air-open-top chambers at the Biglerville site. In comparison, vines within filtered air chambers remained asymptomatic. During a September evaluation, Chambourcin grape foliage in the non-filtered chambers had 22 percent of their leaves injured, while comparable plants in the carbon filtered plots had less than 2 percent of the foliage injured. An evaluation of the Vidal grape variety – considered tolerant to ozone injury – had 6 percent leaf injury in the non-filtered treatment and less than 1 percent of its leaves injured in the filtered treatment. The research program provides further evidence that ozone is the cause of significant losses in some agricultural situations and new information concerning the relationships between ambient ozone exposures within grape vineyards in Pennsylvania. The findings will be useful in the review of the National Ambient Air Quality Standard (NAAQS) as conducted by the U.S. EPA with more stringent primary and secondary standards recommended by the Agency's Office of Air Quality Planning and Standards.

Sources of Funding: Hatch Act, Multi-State Hatch Act, and State appropriated funds.

Scope of Impact: Multistate Integrated Research and Extension - AL, CA, IL, MD, MA, MN, NJ, NY, PA, VA, Appalachian State University, Boyce Thompson Institute for Plant Research, USDA-ARS, USDA-ARS Air Quality Research Unit, USDA-ARS Environmental Quality Laboratory, and USDA-Forest Service/CA

Planned Program: Benefits and Costs of Natural Resources Policies Affecting Public and Private Lands (PEN03935)

Key Themes: Agricultural Waste Management, Land Use, Sustainability of Agriculture and Forestry

Brief Description: This planned program contributes to the objectives of a multistate project designed to provide information on the benefits and costs of natural resources policies affecting public and private land. The project research measures the impact that amenities like agricultural and other open space have on market price of residential properties and the impact that disamenities, such as landfills, may have on market value of these properties.

Impact/Accomplishment Statement: The research estimated the impact that various amenities and disamenities, with particular attention to landfills in Pennsylvania, have on residential property values. Results showed that agricultural and other open space have a positive impact on the market price of residential properties

located within 400 meters. Landfills and large-scale animal production facilities negatively affected nearby residential property values. Results also showed that while most landfills do have a negative impact on neighboring property values, 6 to 8 percent of all landfills have no impact. Research results were shared with Pennsylvania citizens and community groups located near three different current or proposed landfills. The information was also used by numerous state and local interest groups and public and private decision-makers in Pennsylvania and presented at a national meeting of state officials regulating concentrated animal feeding operations.

Sources of Funding: Hatch Act, Multi-State Hatch Act, and State appropriated funds.

Scope of Impact: Multistate Research - AL, AZ, CA, CO, CT, GA, IA, KY, LA, ME, MD, MA, MI, NH, NY, ND, OH, OR, PA, TX, UT, WA, WV, and WY

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 FY2004, 50 projects supported Goal 5 themes. The three planned programs featured below illustrate accomplishments and impacts within this Goal. Hatch-funded research on the competitiveness of the Pennsylvania wood products industry has a direct bearing on the economic well-being of many communities in the state. This project is applying engineering process control to the operation of local wood industry operations, and lean manufacturing techniques are being introduced to the industry. Foreign competition has been a major threat to the wood products industry, and increasing competitiveness through efficiency is one approach to retaining this major employment opportunity for rural Pennsylvania communities. A survey-based project on rural Pennsylvania livelihood strategies demonstrated that informal work has apparently become an economic strategy practiced as a supplement to formal employment by a broad cross-section of society and is not restricted to the poor. These findings, along with other insights into rural economic well-being, were presented to academic and local audiences (e.g., a conference sponsored by the Fayette (PA) County Human Service Council), so the concepts are reaching local decision-makers.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 5 were approximately \$344,314 in FY2004, a reduction of approximately 9.7 percent over the FY2003 level of \$381,265. Overall expenditures tracking to Goal 5 projects were also lower (approximately \$3.4 million in FY2004, down 8.4 percent from FY2003). State appropriated expenditures decreased approximately 2.3 percent and external grant expenditures decreased by approximately 15.1 percent during FY2004. One new faculty hired during FY2004 would be characterized as having proposed research activities primarily within Goal 5 themes. 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-1001, NC-1002, NE-1011, NE-1012). One of the featured planned projects below, project PEN03848 contributes to NC-1002. Individual impact statements are available on the web at the National Information Management and Support Systems at <http://nims.umd.edu/>.

Allocated FTEs to Goal (in units):

SY	PY	TY	CY	TOTAL
21.8	21.8	0.0	5.1	48.7

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

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
\$269	\$75	\$20	\$0	\$1,698	\$1,320	\$3,381

The following agencies/sponsors provided leveraging dollars:

- | | |
|-----------------------------------|---|
| American Sociological Association | Pennsylvania Department of Agriculture |
| Bio-Cide International Inc. | Pennsylvania Department of Conservation and Natural Resources |
| Center for Rural Pennsylvania | Pennsylvania Department of Energy |
| Centre County Government | Pennsylvania Department of Environmental Protection |
| Environmental Protection Agency | Pennsylvania Department of Transportation |
| Kane Chamber of Commerce | Pennsylvania Fish and Boat Commission |
| National Audubon Society | Pennsylvania Game Commission |
| National Institutes of Health | United States Department of Agriculture |
| National Research Foundation | United States Department of Interior |
| National Science Foundation | |
| PennFuture | |

Planned Program: Developmental Antecedents of Civic Competence in a Global Society (PEN03691)

Key Themes: Children, Youth, and Families at Risk, Conflict Management, Leadership Training and Development, Youth Development/4-H

Brief Description: Over the course of adolescence, young people develop their understanding of democracy and their role in it. Their concepts are formed through formal learning at school and through non-formal opportunities in extracurricular and community-based organizations. One of the main purposes of public education is to enable full participation of the people in the life of a democracy. This planned program conducted a study on the association of teaching practices and school climates with adolescents' beliefs about justice in America and with their civic values.

Impact/Accomplishment Statement: The study included nine hundred middle and high school students from urban and rural communities who were asked about their views of the climate and teaching practices at their school. The students were from African-, Latino-, European-, and Arab-American backgrounds. Students' views about the school climate and teaching practices were significantly related to their beliefs that America was a just society and to the teens' personal goals of public service and the promotion of inter group tolerance and understanding. Inclusive climates at school where caring transcended the borders of cliques, where teachers insisted on a civic ethic (intervening to stop acts of intolerance or bullying, insisting that students listen to and respect one another) and where teachers held the same high academic expectations for everyone were positively related to: adolescents' beliefs that America was a just and equal opportunity society; adolescents' intentions to serve their communities and country; and adolescents' intentions to promote equality and inter group

understanding. These results were consistent for all racial and ethnic groups. The research suggested that, by the kind of public space they provide, schools are the place where children can develop an understanding of what it means to live in a Civil Society and how members of such a society treat one another. To achieve those ends, the choices of teachers, administrators, and fellow students are pivotal.

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

Scope of Impact: State Specific

Planned Program: Gender, Agriculture, and Environment (PEN03723)

Key Themes: Agricultural Financial Management, Impact on Change on Rural Communities, Jobs/Employment, Multicultural and Diversity Issues, Small Farms and Their Contribution to Local Economies, Workforce Preparation – Youth and Adult

Brief Description: Farm women in the U.S. make significant contributions to agricultural production through their involvement in farm work, farm decisions, and agricultural organizations. Unfortunately, national level census statistics severely underestimate the level of women's involvement in farm enterprises and data have not been collected since 1980. Since that time, many changes have occurred in farm participation and organization trends, but little information exists concerning the impact of these changes on farm women's participation in agricultural activities. This research program analyzes the nature and extent of women's participation in farm operations and their contributions to farm households in the U.S.

Impact/Accomplishment Statement: A major national survey of 2,661 farm women across the U.S. was conducted in 2001. Results found that 53 percent of U.S. farm women consider themselves to be the main or one of the main operators of the farm. Relative to the data collected in 1980, farm women in the 2001 survey are more likely to be involved in making major decisions related to farm operation, including decisions related to the use of farm land. Farm men who were also surveyed were more likely to report that their spouses were involved in farm decision-making than the women themselves. These research findings are providing useful information to policy makers about women's level of involvement in farm enterprises. In addition, farm organizations and women and agricultural organizations have used the information from the study to plan their programs. National, state, and local media have also used the findings from the survey to highlight the important role of women in agriculture in the U.S.

Sources of Funding: Hatch Act and State appropriated funds.

Scope of Impact: State Specific

Planned Program: How Do Structured Out-of-School Experiences Contribute to Positive Youth Development (PEN03848)

Key Themes: Children, Youth, and Families at Risk, Conflict Management, Youth Development/4-H

Brief Description: After-school hours are times of great risk for unsupervised youth and parents need safe alternatives for their youth. This research program contributed to a multistate effort by conducting a study to investigate high school youth's participation in structured activities during the out-of-school hours.

Impact/Accomplishment Statement: This investigation used a participation on-line survey targeted at middle and high school youth. (The survey can be viewed at <http://www.humanserviceresearch.com/evaltools/screen1.cfm>). The survey asked youth about how they made their decisions to join certain activities and not join or quit other activities, what they do in those activities, and what they get from being involved in those activities. Investigators are working with youth-serving organizations program staff to encourage middle and high school youth to take part in the study which specifically focuses on youth participation in organized activities such as band, debate team, school sports, community sports, community choral society, 4-H club, and others. Participants are asked questions like: how they made their decisions to join certain activities; why they chose not to join an activity; why they decided to quit an activity; what they do in those activities; and what they get from being involved in those activities. Findings from this study will help better understand youth needs and desire so educators and stakeholders can better design programs that attract young people and enhance their development.

Sources of Funding: Hatch Act, Multi-State Hatch Act, and State appropriated funds.

Scope of Impact: Multistate Integrated Research and Extension and International - AZ, CA-D, IL, IN, IA, KY, MA, MI, MN, PA, WV, and Australia

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, FY2003, and FY2004.

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 FY2004 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, the Pennsylvania Landscape and Nursery Association, and the Pennsylvania Floral Industry Association, among many others. We also have direct connections with the Penn State Agricultural Council (<http://agcouncil.cas.psu.edu>) and, through the council, the 106 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 continue to identify the need to develop new novel methods to track pathogens in food processing plants that will allow the industry to develop intervention strategies for their control (PEN03952), to prevent outbreaks of food-borne illness and improve the quality of foods. Results of this research are validated under laboratory conditions and findings of these new methods concepts can also be applied to trace the origin of a biological warfare agent for forensic purpose. Research conducted to investigate high school youth's participation in structured activities during the out-of-school hours (PEN03848) will help better understand the needs and desire of this high risk population of unsupervised youth. Findings will help educators design better programs and offer parents with safe alternatives for their children.

Program Review Process: There have been no significant changes in the Merit and Peer Review processes during FY2004 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 FY2004. 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 three new faculty added to the Experiment Station in FY2004. 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 FY2004 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 2004, we continued to provide 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. Multistate project (PEN03848), a middle- and high school program was designed to survey students to investigate their participation in structured activities during out-of-school hours. Findings will help educators and stakeholders in better design of programs that can enhance the development of these youth at risk. As part of an effort to better understand the role that women in rural communities play in farming, our planned program PEN03723 conducted a major national survey of farm women across the United States. State agency stakeholders are supporting our research efforts because women in agriculture are a group that has not been reached enough.

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. As an example, in multistate Project PEN03848, which is featured in Goal 5 of this report, a Penn State researcher collaborated with the University of Arizona to create the "National Youth Participation Study" that focuses on

youth participation in organized activities. The findings were disseminated at in-service programs and at national professional association meetings, and evaluation tools about practices are given to practitioners.

Integrated Research and Extension Activities: Of the 550 administrators, faculty, and staff at University Park who are supported with research funds, 257 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.

¹The resources indicated in this document are based on FY2004 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)**

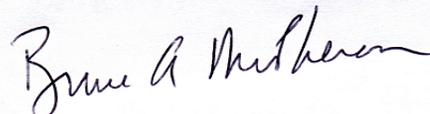
Institution: PA Agricultural Experiment Station

State: Pennsylvania

Check one: **Multistate Extension Activities**
 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
<u>Joint Research and Extension Personnel Appointments</u>	<u>\$1,511,058</u>	<u>\$1,509,013</u>	<u>\$1,456,953</u>	<u>\$1,623,063</u>	<u>\$1,600,536</u>
<u>Fruit Research and Extension Center</u>			<u>\$11,281</u>		
<u>Lake Erie Regional Grape Research and Extension Center</u>			<u>\$7,000</u>		
<u>Southeast Agricultural Research and Extension Center</u>			<u>\$1,000</u>		
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Total	<u>\$1,511,058</u>	<u>\$1,509,013</u>	<u>\$1,476,234</u>	<u>\$1,623,063</u>	<u>\$1,600,536</u>



Bruce A. McPheron, Director
 PA Agricultural Experiment Station

March 31, 2005

Date