ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

for the
Pennsylvania Agricultural
Experiment Station
at
The Pennsylvania State University

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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.

Overview: The Pennsylvania Agricultural Experiment Station continues to focus on research projects that reinforce a globally competitive agricultural system. During FY2001, 172 projects supported Goal 1 themes. The two planned projects that are featured below illustrate accomplishments and impacts within this Goal. Additional highlights include research on the use of geographic information systems to examine and predict influx of insect pests into crop fields. This project has led to an insecticide resistance management plan for Colorado potato beetle, a pest with a long history of evolving resistance to the newest pesticides registered to combat it. The identification of host preferences by the invasive species Asian longhorned beetle have led agriculture and forestry officials to reconsider the potential of this pest to establish in North America. New methods for rapid identification of bovine viral pathogens were developed. Research on annual and perennial flowers and vegetables led to recommendations and adoption by commercial producers. On-farm research with a focus on sustainable methods of agricultural production is of high importance to Pennsylvania residents, and we have instituted such a program during FY2001. This research program is, in part, a result of continuing dialogue with the Pennsylvania Association for Sustainable Agriculture and is supported by a USDA special grant. The importance of dairy management practices to Pennsylvania agriculture and the Pennsylvania economy can be overstated. USDA special grants also help to support research in this critical area.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 1 were approximately $3.46 million in FY2001, a reduction of 4.4 percent from the FY2000 level of $3.62 million. Overall expenditures tracking to Goal 1 projects were also lower ($27.2 million in FY2001, down 2.5 percent from FY2000). State appropriated funds declined slightly during this time period, while external grant funding was moderately higher. Twelve of 18 faculty hired during FY2001 have a significant proportion of their proposed research activities within Goal 1 themes. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 255 graduate students can be expected to be working on research projects consistent with Goal 1 themes.

Among the significant hires related to Goal 1 in FY2001, we have enhanced our capacity to conduct research on animal disease issues at the basic and applied levels. We also have committed to increased efforts on plant disease epidemiology and detection. Pennsylvania is experiencing increased demand from stakeholders for sustainable agriculture answers, and we have augmented our faculty in this area through the hire of a weed scientist and an entomologist specializing in aspects of biological control. Contributing across all of these areas is a specialist in the modeling of biological systems who brings expertise in animal and plant system models.

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. Our two featured planned programs below are both in support of multistate efforts. Thirty of our experiment station projects contribute to

multistate projects within Goal 1 (NC-119, NC-129, NC-131, NC-140, NC-142, NC-185, NC-205, NC-221, NC-226, NE-009, NE-124, NE-127, NE-132, NE-140, NE-148, NE-161, NE-164, NE-171, NE-176, NE-183, NE-184, NE-185, NE-187, NE-501, NE-1001, S-274, S-284, S-289, S-291, W-195). 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
128.3	225.0	51.3	85.8	490.4

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

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$2,707	$755	$175	$60	$13,874	$9,650	$27,221

The following agencies/sponsors provided leveraging dollars:

Academy of Applied Sciences
American Agricultural Economics Association
American Cancer Society
American Cocoa Research Institute
American Floral Endowment
Andrew W. Mellon Foundation
Bayer Pursell LLC
Binational Agricultural Research and Development
California Citrus Research Board
Centro Internacional de Agricultura Tropical
Conservation, Food and Health Foundation
Environmental Protection Agency
Fred C. Gloeckner Foundation, Inc.
Golf Course Superintendents Association of America Foundation
Greater Pittsburgh Golf Course Superintendents Association
Heinz Family Foundation
International Atomic Energy Agency
Johnson & Johnson
Leukemia Research Foundation
McKnight Foundation
National Aeronautics and Space Administration
National Geographic Society
National Institutes of Health
National Science Foundation
New York Wine and Grape Program
Ohio Floriculture Foundation
Pennsylvania Department of Agriculture
Pennsylvania Department of Conservation and Natural Resources
Pennsylvania Department of Transportation
Pennsylvania Fish and Boat Commission
Pennsylvania Soybean Promotion Board
Pharmacia Corporation
Pioneer Hi-Bred International, Inc.
PPG Industries, Inc.
State Horticultural Association of Pennsylvania
State of California
United States Department of Agriculture
United States Department of Defense
United States Department of Education
United States Department of Interior
United States Golf Association
Wild Resource Conservation Fund

Planned Program: Multidisciplinary Evaluation of New Apple Cultivars (PEN03731)

Key Themes: Plant Germplasm and Plant Production Efficiency

Brief Description: The development of improved crop varieties is at the heart of maintaining agricultural competitiveness. It is a daunting prospect under the best of conditions, but tree fruit require extreme patience to take a promising cultivar from the earliest recognition of promise to commercial availability. This state experiment station project is a multidisciplinary effort on the part of station scientists, working within the framework of a broader multistate effort, to evaluate apple cultivars over a multi year period using criteria from entomology, pomology, plant pathology, and economics. Plantings were established at two sites in 1995 and 1999 and are evaluated annually. Plant phenology, plant size and growth, fruit size and quality, and yield data were collected. Pest abundances were also measured on all cultivars at the two sites.

Impact/Accomplishment Statement: Documentation of differences among apple cultivars in commercially relevant traits is of critical importance to our stakeholders. Orchard establishment is a significant investment, and advance knowledge of cultivar attributes under a variety of environmental conditions makes the choice easier for a grower. Some cultivars with high consumer appeal may not be suitable for the particular growing conditions faced by industry in a geographic region. Furthermore, this sort of evaluation protocol permits researchers to

design pest management and general orchard management strategies that consider the inherent traits of the cultivars. Higher levels of pest resistance may lead directly to lower levels of pesticide use, for example. Data from this state experiment station project are shared regionally through the relationship with NE-183, which has been an exceptionally powerful vehicle for collaborative research and information delivery.

Sources of Funding: Hatch Act, Multistate Hatch Act, and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from the State Horticultural Association of Pennsylvania.

Scope of Impact: Multistate Integrated Research and Extension - AL, AR, CT, IN, MA, ME, MI, NC, NH, NY, OH, OR, PA, UT, VA, VT, WA, WI, and WV.

Planned Programs: Eradication, Containment and/or Management of Plum Pox (Sharka) Disease (PEN03756)

Key Themes: Invasive Species and Plant Health

Brief Description: The appearance of the plum pox virus in south central Pennsylvania in 1999 set a number of responses in motion. The first concerns were delimitation and containment, but it was quickly acknowledged that substantial research was required to support eradication or management efforts. This Pennsylvania research project is directly addressing the implications of this invading virus for stone fruit production in Pennsylvania, the nation, and the continent. In FY2000, a primary focus of research was the possibility that plum pox virus could become established in common weeds or native tree species as a result of vector movement among host plants. Ten sites were identified for study, all in proximity to infected (but now removed) orchards or packing house discard areas. All plants except grasses and conifers were collected, identified to species, and examined using ELISA methods and polymerase chain reaction techniques.

This project was leveraged against a critical effort waged with state and other federal funding. Quarantine activities, including orchard and homeowner surveys, testing of plant material, and destruction of infected trees, were continued through the reporting period. The multi-state web site describing the project can be found at http://sharka.cas.psu.edu/.

Impact/Accomplishment Statement: A total of 17,197 plant samples from 251 species of weeds and native trees tested for plum pox virus returned negative results. The native tree samples included *Prunus* spp., particularly wild cherry. Ornamental samples from homeowner properties with virally-infected peaches were also negative for virus. One lily sampled in this survey contained an unknown virus that cross reacted in the ELISA test for the plum pox virus; this has some implications for the specificity of the test.

The effort to examine all potential alternate hosts of plum pox virus is critical for the eradication effort underway. Any of these hosts, if infected, would serve as a reservoir for the virus that might be tapped by an aphid vector moving among host plant species to feed. If eradication is successful, the availability of empirical data on alternate hosts will facilitate future monitoring efforts for reintroduction of the virus.

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

Scope of Impact: Multistate Integrated Research and Extension - AL, AR, CA, DE, FL, GA, MA, MD, MI, MO, NC, NJ, NY, OH, PA, SC, TN, and WA. Also, USDA/ARS in MD and USDA/ARS in VA.

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.

Overview: The Pennsylvania Agricultural Experiment Station supports a variety of projects that contribute to safe, secure food and fiber production. During FY2001, 44 projects supported Goal 2 themes. The planned project featured below illustrates accomplishments and impacts within this Goal. Additional highlights include work to develop desirable horticultural traits in tomato, particularly increased fruit lycopene content, which has been implicated in decreased incidence of certain cancers, coronary heart disease, cataracts, and macular degeneration. The Penn State Milk Safety research program, funded by a USDA special grant, has focused on recognizing and responding to pathogenic *E. coli* strains in raw milk. These pathogen strains are responsible for an estimated 270,000 of the 76 million cases of food-borne illnesses annually in the United States and pose a particular threat to dairy producers and their families, who often consume raw milk.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 2 were approximately $568,000 in FY2001, an increase of 12 percent over the FY2000 level of $507,000. Overall expenditures tracking to Goal 2 projects were also higher ($6.1 million in FY2001, up nearly 18 percent from FY2000). State appropriated funds declined slightly during this time period, but external grant funding increased over 21 percent. No new faculty hired during FY2001 would be characterized as having proposed research activities primarily within Goal 2 themes. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 69 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 Pennsylvania Food Industry Alliance http://pfia.cas.psu.edu. Other stakeholder concerns on 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. Seven of our experiment station projects contribute to multistate projects within Goal 2 (NC-129, NC-136, NE-103, NE-127, NE-179, NE-183, S-294). For example, Pennsylvania project 3777 contributes to NC-136 and has focused on the dynamics of *Salmonella enteritidis* infection of eggs under a variety of handling and storage regimes. New rapid cooling protocols are necessary to reduce the risk of *S. enteritidis*. 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
34.8	45.8	2.0	20.6	103.2

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

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$485	$83	$0	$0	$3,005	$2,568	$6,142

The following agencies/sponsors provided leveraging dollars:

Allied Domecq Retailing
American Cancer Society
American Floral Endowment
American Mushroom Institute
Cadbury Chocolate Canada, Inc.
Centro Internacional de Agricultura Tropical
Dairy Management Inc.
Diamond V
Fred C. Gloeckner Foundation, Inc.
General Mills
Hazelnut Council
National Cattlemen's Beef Association
National Institutes of Health
National Pork Producers Council
National Science Foundation
Pascobel Company
Pennsylvania Department of Agriculture
Pennsylvania Manufacturer of Chocolate Association
Pennsylvania Soybean Promotion Board
Pfizer - Warner Lambert
Pioneer Hi-Bred International, Inc.
Roche Vitamins and Fine Chemicals
Strategic Alliance Management Committee
United States Department of Agriculture
United States Golf Association

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

Key Themes: Food Safety and Food Handling

Brief Description: This state experiment project focuses on control of pathogenic and spoilage microorganisms to enhance food safety and quality. A major goal of this research program is the identification of novel, economical, and effective mechanisms. Ozonation was investigated for alfalfa seed/sprout decontamination using a variety of approaches, including ozonated water, direct ozone bubbling (with or without surfactants, with heat treatment, with increased pressure). Electrolyzed oxidizing water was also explored as an agent for decontamination of food material (vegetables, meats, ready-to-eat food products), both alone and in combination with ozonation. Investigators evaluated the potential of using electrolyzed water in a farm milking system decontamination process called Cleaning-In-Place.

A pilot-scale unit was developed to look at new possibilities for produce decontamination using antimicrobial solutions.

Efforts to produce antimicrobial compounds via microbial fermentation at low cost involved use of biofilm reactors. The initial focus was on nisin production.

Effect of packaging materials on pathogen inactivation during irradiation of meat was studied.

Impact/Accomplishment Statement: The Center for Disease Control and Prevention estimate that 76 million illnesses and 5,000 deaths annually in the United States are attributable to food-borne disease outbreaks. This problem has been on the increase in the last 50 years, and that treatment costs are currently estimated to exceed $8 billion annually. The development of low-cost effective treatments for food-borne pathogens will have a direct impact on reducing the incidence of these problems. Current methods for disinfection of milking systems are expensive and energy-intensive. A pilot-scale study of electrolyzed water for Cleaning-In-Place is planned to examine this as an effective and affordable alternative.

Use of antimicrobial compounds as preventative agents has been limited by high cost of the compounds. Development of cost-effective alternatives for compound production will enhance the suite of tactics available.

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

Overview: The Pennsylvania Agricultural Experiment Station engages in a variety of projects that contribute to a healthy, well-nourished citizenry. During FY2001, 33 projects supported Goal 3 themes. The two planned projects featured below illustrate accomplishments and impacts within this Goal. Additional highlights include a variety of projects that examine sociological impacts on human health. The outcome of economic restructuring in communities has an effect on income inequality, which translates into health and nutrition choices within families. Another state project focused on the impact of EFNEP education on dietary adequacy and food-related behaviors of participants. Results from this project suggest that EFNEP education has a significant impact on the prevalence of desirable changes in nutrition, food safety, and food resource management practices.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 3 were approximately $347,000 in FY2001, an increase of nearly 37 percent over the FY2000 level of $254,000. Overall expenditures tracking to Goal 3 projects were also higher ($6.1 million in FY2001, up nearly 18 percent from FY2000). State appropriated funds declined slightly during this time period, but external grant funding increased over 29 percent in FY2001 to $2.25 million. Two new faculty hired in our Department of Food Science during FY2001 would be characterized as having proposed research activities primarily within Goal 3 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 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.

Multistate projects are an important part of our activity under Goal 3 themes. Three of our experiment station projects contribute to multistate projects within Goal 3 (NE-162, NE-177, NE-185). For example, Pennsylvania project 3603 contributes to NE-185 through research on programs to communicate nutritional information to low-income communities. 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
14.9	15.1	0.0	6.9	37.0

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

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$273	$74	$0	$0	$922	$1,042	$2,250

The following agencies/sponsors provided leveraging dollars:

Center for Rural Pennsylvania
Environmental Protection Agency
Heinz Family Foundation
Kane Chamber of Commerce
National Institutes of Health
National Science Foundation
Ohio Floriculture Foundation
Pennsylvania Department of Agriculture
Pennsylvania Landscape and Nursery Association
Roche Vitamins and Fine Chemicals
Rocky Mountain Elk Foundation
Southwestern Pennsylvania Heritage Preservation Commission
United States Department of Agriculture
United States Department of Interior

Planned Program: Identifying Strategies for Increasing Confidence in the U.S. Food System (PEN03610)

Key Themes: Human Nutrition and Human Health

Brief Description: Food safety issues are a perennial concern in agriculture, and recent attention on genetically modified foods and bioterrorism highlight the continued relevance of this state experiment station project. This project has tracked national trends in consumer awareness of food-related hazards, such as *Salmonella, E. coli,* pesticides, and *Listeria*. At the same time that concerns have increased in the population, their awareness levels have also increased.

The survey showed a variety of results of interest. Only a minority of survey respondents are very confident that food sold in supermarkets and restaurants is safe. Also, only a minority of Americans are very confident that farmers, food processors, and government inspectors are doing a good job in protecting our food supply, although farmers are most trusted.

A March 2001 survey addressed the question as to whether genetically modified foods would be considered a food safety issue. Of 2,000 respondents, only 52 percent of Americans had heard or read about food produced from genetically modified plants. Young people across gender, race, and educational background are generally uninformed. Of those who had heard of genetically modified foods, 13 percent were positive, 29 percent neutral, 22 percent negative, and 36 percent undecided.

Impact/Accomplishment Statement: The results of the 2001 survey were shared with the Research Triangle Institute and the USDA Food Inspection Service. The results of the survey on genetically modified foods and food safety revealed two important issues. First, there is a large proportion of the population that is uninformed about the issue and only a small fraction of people surveyed had made up their minds. This suggests that quality educational programs providing unbiased information to the 75 percent of respondents who said they would like to learn more could have a significant impact. Second, the best predictor of positive feelings about food safety was trust in the agencies involved with food regulations.

Sources of Funding: Hatch Act and State appropriated funds.

Scope of Impact: State Specific

Planned Program: Examining Food Issues in Resource Stressed Families, Households, and Communities (PEN03658)

Key Themes: Human Health and Human Nutrition

Brief Description: This state research project supports research on a variety of programs that provide effective nutrition and health-related information to Pennsylvania citizens. The focus of the programs is on low-income individuals, families, and communities. Research on how such households make food choices is limiting. A survey of Cooperative Extension agents and an informal survey of food stamp recipients was conducted to identify the needs of particular audiences; adolescent/young parents were identified as the priority audience through this study. A study was initiated to examine the health and nutrition needs of pregnant and parenting teenagers in rural Pennsylvania. An inventory of existing data sets and interviews with program providers will permit programs to be devised to address the particular needs of this clientele. Studies on dietary strategies among married diabetics were continued.

Impact/Accomplishment Statement: The community based food project "Edible Connections" is now being prepared for adaptation to use in New Jersey and New York in addition to Pennsylvania. Community Food Project activities in Pennsylvania were profiled in a 27-minute video (Our Food – Our Future) produced in collaboration with USDA/CSREES and several other states. Approximately 70 public television stations have been licensed to show this video. The Nutrition Education Program (NEP) reached 3864 pregnant and parenting teens and young women indirectly, 129 through a series of lessons, and 997 through one-time educational activities. Seventy-five percent of participants acquired behaviors that have a positive effect on nutritionally sound eating habits and a healthy lifestyle, according to posttest results. Nearly 50 percent of newsletter recipients reported a behavior change as a direct result of these newsletters on nutrition.

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

Scope of Impact: 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.

Overview: 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 FY2001, 84 projects specifically supported Goal 4 themes. The three planned projects featured below illustrate accomplishments and impacts within this Goal. Additional highlights from state experiment projects include the adoption of research results from cultivar tests to enable urban planners to select tree varieties with appropriate growth characteristics for challenging sites, particularly under utility wires. Pennsylvania utilities have instituted a grants program on the basis of this research that permits municipalities to plant utility-compatible varieties and augment their maintenance budgets. Prediction of appropriate water treatment responses to acid mine drainage was the goal of another state project. Cost estimates for these treatments were generated and compared to the results of extensive public surveys to

assess the amount that the public would be willing to invest for restoration of water quality to fishable conditions vs. drinking water quality. Studies of the effect of habitat fragmentation on Neotropical migrants revealed that, in addition to the unfragmented habitats required for successful breeding of these species, edge habitats and suburban woodlots are important during spring migration. These disturbed habitats must be factored in to habitat management decisions. Fish culture methods to successfully propagate two endangered minnow species have been successful to the point that future work in a state project will focus on reintroduction programs. Software was developed that will be used in the coming year by the Pennsylvania Bureau of Forestry to develop management plans for Pennsylvania's 20 state forests. This software will permit the agency to better understand the consequences that their decisions on personnel and budget may have on medium and long-term ecological, social, and economic objectives in the management of these forest resources.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 4 were approximately $1.16 million in FY2001, slightly higher than the FY2000 level of $1.08 million. Overall expenditures tracking to Goal 4 projects were significantly higher (over $11 million in FY2001, more than 19 percent higher than in FY2000). Both state appropriated funds and external grant funding increased during FY2001. Two new faculty hired during FY2001 would be characterized as having proposed research activities primarily within Goal 4 themes. Graduate students are assigned to goals in proportion to faculty assignments. Approximately 93 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. Thirteen of our experiment station projects contribute to multistate projects within Goal 4 (NE-009, NE-060, NE-127, NE-171, NE-183, NE-184, NE-1001, NRSP-003, S-290, S-291, W-133, W-170, W-195). One of the featured planned projects below, Pennsylvania project 3824, contributes to NE-1001. In addition, Pennsylvania project 3618, which is allied with NRSP-3, has provided substantial data from the local monitoring site to the national effort to track and predict the impact of the 1990 amendments to the Clean Air Act. 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
46.8	102.3	4.7	36.6	190.4

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

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$900	$256	$289	$0	$5,384	$4,214	$11,043

The following agencies/sponsors provided leveraging dollars:

American Cocoa Research Institute
Binational Agricultural Research and Development
Centre County Government
Centro Internacional de Agricultura Tropical
Conservation, Food and Health Foundation
Environmental Protection Agency
Fred C. Gloeckner Foundation, Inc.
Great Lakes Commission
Institute of International Education
Kane Chamber of Commerce

Monroe County Planning Commission
National Audubon Society
National Pork Producers Council
National Science Foundation
New York Wine and Grape Program
Ohio Floriculture Foundation
Penn State - Office of Physical Plant
Pennsylvania Department of Agriculture
Pennsylvania Department of Conservation and Natural Resources
Pennsylvania Department of Environmental Protection
Pennsylvania Department of Transportation
Pennsylvania Dept of Military and Veteran Affairs
Pennsylvania Fish and Boat Commission
Pennsylvania Game Commission
Pennsylvania Soybean Promotion Board
Pioneer Hi-Bred International, Inc.
PPG Industries, Inc.
Rocky Mountain Elk Foundation
Southwestern Pennsylvania Heritage Preservation Commission
Susquehanna River Basin Commission
Tinker Foundation Incorporation
United States Department of Agriculture
United States Department of Interior
Wild Resource Conservation Fund
Wildlife Management Institute

Planned Program: Application of Sewage Biosolids to Agricultural Soils in the Northeast: Long-Term Impacts and Benefit Uses (PEN03824)

Key Themes: Nutrient Management, Soil Quality and Water Quality

Brief Description: Sustainability of soil quality, water quality, and food safety is a key issue in maintaining productive agricultural production. The application of sewage sludge biosolids to agricultural lands contributes to soil fertility, but also raises legal, social, and political issues surrounding the agriculture-urban interface. This Pennsylvania research project is part of a multi-state effort to address this subject. Phosphorous levels are one important component of any soil amendment, so research has focused on comparison of experimental biosolid treatments with manures and manure composts and conventional fertilizers. Biosolid effect on elemental uptake is also an important consideration for maintaining production levels. Twenty farms were sampled for plant tissue and soil analyses of plant nutrients and trace elements. Fields receiving biosolid treatments were paired with fields that had never received biosolids.

Impact/Accomplishment Statement: Half of all biosolids produced in the United States are applied to the land, but a variety of environmental and health issues have not been adequately addressed, including the biogeochemical cycling of plant nutrients and trace elements. Biosolids did not affect soil pH, magnesium, sodium, or ammonium, but there were increases in soil phosphorous, total and organic carbon, calcium, and nitrates. In addition, there were increases noted in a variety of metals, including arsenic, chromium, copper, mercury, molybdenum, lead, and zinc, although not in selenium or nickel. Relative to standards published by the US EPA (503 standards), these increased levels ranged from 0.1 – 2.7 percent. There was no effect of biosolid application on plant tissue concentrations of any measured macro- or microelements.

The current focus on phosphorous-based nutrient management forces us to examine the implications of land-applied biosolid materials. Water extractable phosphorous from 42 biosolids, 13 manures or manure composts, and 2 fertilizers revealed that phosphorous levels were significantly lower from the biosolid samples than the other samples. Studies revealed that the phosphorous was likely stabilized by aluminum and iron present in the biosolid materials. These results will be useful in considering the role that biosolids may play as alternative sources of agricultural nutrients as we balance plant production with environmental pollution.

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

Scope of Impact: Multistate Integrated Research and Extension - MA, NH, NJ, NY, and PA.

Planned Program: Assessment and Management of Soil and Land Resources Using Geographic Information System Technology (PEN03601)

Key Themes: Land Use and Water Quality

Brief Description: The role of geographic information systems (GIS) on land use planning is significant. This Pennsylvania experiment station project focuses on discovering new methods by which digital data about land, natural resources, and human activity can be assembled, analyzed, and disseminated. The digitization of the Pennsylvania soils database is continuing, involving collaboration with a wide variety of state and federal agencies. The USDA-NRCS Map Compilation and Digitizing Center is located in the Department of Crop and Soil Sciences facility here at Penn State. WEBGIS approaches provide easy access to an array of digital data without the need for each user to have access to their own specialized software. Penn State's Land Analysis Laboratory is dedicated to novel approaches for making these data available. The development water resources in the Laurel Ridge region in southwest Pennsylvania will be enhanced by a decision support system developed under this project in collaboration with the Soil Conservation Service and the Somerset and Westmoreland County, PA, Conservation Districts. Impact of any proposed water supply wells on the local aquifer and surrounding wells will be assessed via this software. Other projects include prioritization of land parcels for the state Farmland Preservation program and cooperation in the development of the Chesapeake Bay Decision support system to address agricultural nonpoint source pollution issues.

The Penn State Land Analysis Laboratory is one of eight sites that make up the National Consortium for Rural Geospatial Innovation in America (RGIS; http://www.ruralgis.org).

Impact/Accomplishment Statement: The Pennsylvania Spatial Data Access (PASDA) website (http://www.pasda.psu.edu/) has been enhanced to improve environmental use of GIS technology. When complete, it will provide interactive WEBGIS capabilities, some of which are in place at present. Project investigators have contributed to an effort to provide GIS technical services to the Pennsylvania State Government. A new delivery tool called AgMap has been developed to permit citizens and agribusinesses to use digital spatial data to search for and advertise agricultural services (http://cegis3.cas.psu.edu/AgMap/Application/). Over 400 businesses have taken advantage of this application of WEBGIS technologies.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from the Centre County Government, the Environmental Protection Agency, the Pennsylvania Department of Agriculture, the Pennsylvania Department of Environmental Protection, the Pennsylvania Department of Transportation, and the United States Department of Agriculture.

Scope of Impact: Integrated Research and Extension and Native American Outreach

Planned Program: Nutrient Management in Crop-Livestock Systems (PEN03629)

Key Themes: Soil Quality, Nutrient Management, and Water Quality

Brief Description: The fate in the environment of nitrogen and phosphorous from animal manure and treated animal wastes is the focus of this state experiment station project. Nutrient management continues to be a key concern for water quality throughout Pennsylvania and the United States. The development of nutrient management plans will help agricultural producers cope with these issues. A final year's data were collected to evaluate nutrient availability from swine manure. These data were collected through three on-farm experiments where yield, nitrate levels, and chlorophyll meter information were recorded under different manure/nitrogen fertilizer regimes. Similar studies continue using dairy manure, poultry manure, and composts made from these

materials. Continued efforts are underway in cooperation with the USDA-ARS Pasture System and Watershed Research Unit to modify and refine the Phosphorous Site Index in development for use in Pennsylvania. This work involves eleven on-farm sites.

Impact/Accomplishment Statement: The results of the long-term swine manure study have been provided to relevant agencies for nutrient management planning and the results of the study have been publicized by inclusion in the Penn State Agronomy Guide (http://AgGuide.agronomy.psu.edu/). Accomplishments from work on the Phosphorous Site Index are provided to decision makers in Pennsylvania and other states. The Pennsylvania Nutrient Management Advisory Board and the State Conservation Commission are using these results to develop proposed changes in state nutrient management quality.

Sources of Funding: Hatch Act and State appropriated funds. This planned program also leveraged the appropriated funds by receiving funds from the Environmental Protection Agency, National Pork Producers Council, the Pennsylvania Soybean Promotion Board, the Pennsylvania Department of Agriculture, Pursell Technologies, Inc., and the United States Department of Agriculture.

Scope of Impact: State Specific

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.

Overview: The Pennsylvania Agricultural Experiment Station supports a variety of projects that contribute to enhanced economic opportunity and quality of life. During FY2001, 47 projects supported Goal 5 themes. The two planned projects featured below illustrate accomplishments and impacts within this Goal. Additional highlights from state experiment projects include a major effort, implemented under one Pennsylvania state project, to conduct a statewide public opinion poll called the Citizens' Viewpoint. This survey contacted over 4,000 Pennsylvania residents to provide a comprehensive picture of public opinion. This effort was a follow-up to similar surveys conducted in 1980 and 1990, so it provides valuable historical continuity. The preliminary results of this survey indicate that the highest priority topics to Pennsylvania residents are crime and violence, health care, education, elder care, safe drinking water, job availability, safe disposal of industrial wastes, drug/alcohol abuse, and farmland preservation. Programs developed to improve farm operation agricultural stability were offered to 110 Pennsylvania dairy farmers. Adoption of the workshop concepts, which arose from basic economic research, will increase farm net worth by approximately $3,000 per year. Evaluation of a new program to promote social and emotional competence and prevent behavioral and emotional problems among elementary school students has begun under another state sponsored project. A state project is working with secondary school agricultural science teachers to develop more realistic assessment items for existing curricular materials.

Expenditures of Hatch and Multistate Hatch funds in projects related to Goal 5 were approximately $393,000 in FY2001, lower than the FY2000 level of $427,000. Overall expenditures tracking to Goal 5 projects were also lower (over $3.06 in FY2001, down from $3.19 million in FY2000). Both state appropriated funds and external grant funding decreased slightly during FY2001. Two new faculty hired during FY2001 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 34 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. Six of our experiment station projects contribute to multistate projects within Goal 5 (NC-221, NE-127, NE-167, NE-177, NE-185, W-183). Pennsylvania project 3573, which is allied with W-183, has investigated the impact of non-response to mail surveys on the veracity of survey results. Comparisons of demographics of responders to mail and telephone surveys in two separate studies demonstrates a significant difference in socio-demographic and attitudinal characteristics between the groups. 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
17.3	25.4	0.1	10.5	53.2

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

Hatch	Multistate Hatch	McIntire-Stennis	Animal Health	State Appropriated	Leveraging Dollars	Total
$313	$80	$69	$0	$1,682	$918	$3,062

The following agencies/sponsors provided leveraging dollars:

American Cancer Society
Center for Rural Pennsylvania
Dairy Management Inc.
Heinz Family Foundation
National Institutes of Health
Pennsylvania Department of Agriculture
Pennsylvania Department of Education
Pennsylvania Game Commission
Pennsylvania Landscape and Nursery Association
Pennsylvania Public Utility Commission
U.S. Golf Association
United States Agency for International Development
United States Department of Agriculture
United States Department of Education
William T. Grant Foundation

Planned Program: Preventing Alcohol, Tobacco, and Other Drug Use Among High-Risk Youths (PEN03517)

Key Themes: Children, Youth, and Families at Risk

Brief Description: The goal of this state experiment station project is to address alcohol, tobacco, and drug use prevention among high-risk elementary children. A continuation of long-term studies on the subject, this research is supported by funding from the NIH National Institute on Drug Abuse. The first year of Project Alert, an adult-led, teen-assisted psychosocial drug prevention program was implemented in 8 select Pennsylvania middle schools through collaboration with the Cooperative Extension's 4-H program. The comparative program, an adult-led effort that does not involve teen assistance, was established with cohorts in the same schools. Pretest and posttest survey data from 988 students were collected to examine current use of alcohol, tobacco, and other

drugs, beliefs about the use of these substances by peers, and students' ability to resist pressure to use the substances. A second cohort of seventh-grade students has been identified for the next year of evaluation.

Impact/Accomplishment Statement: Preliminary analysis of the first of four years of student participation suggests that students in the adult-led, teen-assisted Project Alert tend to perceive a lower level of peer drug use. Because prior research suggests that youth with lower perception of peer drug use are less likely to use drugs than their counterparts who perceive higher peer drug use, these results are promising.

Sources of Funding: Hatch Act and State appropriated funds.

Scope of Impact: Multistate Research - AR and FL.

Planned Program: Impacts of Population and Land-Use Change on Local Government Finance in Pennsylvania Communities (PEN03589)

Key Themes: Community Development, Impact of Change on Rural Communities, and Jobs/Employment

Brief Description: The focus of this state experiment station project is to examine how population growth or decline and changes in land use patterns affect local government finances. Development of tools that help local governments and citizens make decisions about these changes is a key goal. In FY2001, one tool developed through this project and its predecessor, CIM-PSU (Community Impact Model—Penn State), was used to evaluate the economic role of the Allegheny National Forest in the Warren County, PA, economy. Multiple local meetings were held with stakeholders to involve their input and help them interpret the outcome of the modeling exercise. A web-based fiscal impact workbook continues to be maintained wit the goal of helping land-use planners, local government officials, and private citizens estimate the cost and revenue impacts of residential development in Pennsylvania. An on-line tool called the Plan-O-Scope was developed to help in assessment of community land use planning. This tool analyzes a user's answer to 12 questions and makes community-specific recommendations on how to improve that community's land use planning.

Impact/Accomplishment Statement: Local government officials, local economic development officials, business person, and interested citizens were impacted by the results of this project. The on-line fiscal impact workbook was used 272 times during the year, and the Plan-O-Scope was used 638 times by the target audience. The research results from this project were used for 27 local educational meetings across Pennsylvania during FY2001, with 971 person-contacts at those meetings. In addition, materials developed regarding the on-line workbook for the Pennsylvania Planning Association annual conference were exhibited at four statewide annual conferences for local officials and citizens.

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

Scope of Impact: Integrated Research and Extension

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 and FY 2001.

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 FY2001 include state-wide or regional meetings of the Pennsylvania Farm Bureau, 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.

Input from stakeholders helped identify emerging issues that require new research. The continuing threat of Plum Pox virus led to establishment of a multidisciplinary collaborative research program on possible weed hosts of the virus in an orchard setting and the importance of multiple vector species. Results of this research are cycled back to stakeholders in the form of management recommendations as soon as the data are validated. The need for new tools in milk handling to ensure the safety of the food supply were communicated through stakeholder listening and Cooperative Extension. These concerns led to research projects to develop new milking equipment decontamination programs described under Goal 2. Surveys of opinion about food safety and genetically modified food (Goal 3, PEN03610) resulted in collaboration between an ag economist and an entomologist to assess consumer acceptance of genetically modified sweet corn and the role of labeling in consumer opinions.

Program Review Process: There have been no significant changes in the Merit and Peer Review processes during FY2001 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 43 multistate projects in FY2001. 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 18 new faculty added to the Experiment Station in FY 2001. 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. In FY2001, the College of Agricultural Sciences offered an internal seed grant program ($200,000) for faculty and staff. A major selection criterion for this program was evidence of integration across research, extension, and teaching.

Multidisciplinary Activities: Nearly all of the research activities conducted by the Pennsylvania Agricultural Experiment Station are multidisciplinary in nature. During FY2001, Penn State instituted a tracking system to examine the role of Colleges in several strategic multidisciplinary initiatives. The College of Agricultural Sciences, of which the Experiment Station is the research enterprise, contributed 9.8 percent of Social Sciences research, 11 percent of Life Sciences research, 6 percent of research in the Children, Youth, and Families Consortium, and fully 50 percent of the research expenditures tracking to Environmental Research. These values are one indication of the significant contribution that our Experiment Station researchers are making to interdisciplinary research here at Penn State.

Evaluation: 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. For example, our project on Eradication, Containment and/or Management of Plum Pox Disease (Sharka) (PEN03756 and PEN03862) was initiated and continues based upon a critical stakeholder need. It represents a dynamic partnership among farmers, state, national, and international agricultural agencies, and several state experiment stations. This project reflects multistate, integrated (research and cooperative extension) and multidisciplinary elements. The relevance of our all of our multistate efforts to the five USDA goals is noted in the previous sections. In addition, the College of Agricultural Sciences engages in strategic planning that serves to identify critical issues at the state level, and faculty are hired and develop their Hatch and multistate projects on the basis of these critical issues. As described above in the stakeholder input process, we routinely present the College (and Station) priorities to a variety of stakeholder groups and obtain feedback from them, which assists us as we iteratively adjust these priorities. The projects that result from this process necessitate integration across function and a multidisciplinary perspective.

We are continuously examining the relevance of our planned programs to underserved and underrepresented populations in the state. In 2001, we provided research funding to faculty to address issues of underrepresented audiences. PEN03789 included elements to examine the impact of cockroaches and other urban pests on inner city, primarily African American, residents. This research will inform Cooperative Extension efforts to improve health conditions under urban conditions. Research on the career choice impact of summer programs that bring underrepresented high school students to interact with Experiment Station faculty for research experiences took place under PEN03587. This project involved close collaboration with resident education efforts in the College. Funding under this internal seed program also supported a joint research/cooperative extension project to examine ethnic minority perceptions and use of public parks and community forest areas. This project is expected to provide information that can be communicated to park administrators and urban planners to facilitate meeting the need of an increasingly multicultural population. Furthermore, faculty engaged in multi and joint activities, as is the case with all of our Experiment Station activities, are regularly made aware of the need to provide research results that are meaningful 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. PEN03756/PEN03862, our Plum Pox multistate project, represents an example of program effectiveness and efficiency. A website that documented quarantine and eradication efforts (http://sharka.cas.psu.edu/) continued to be heavily visited. Project personnel have been widely praised for effectively communicating up-to-date information to stakeholders.

Integrated Research and Extension Activities: Of the 566 administrators, faculty, and staff at University Park who are supported with research funds, 269 have split research and extension appointments. Funds supporting

this research portion of these positions account for the appropriated dollars indicated on From CSREES-REPT (see Appendix A). The dollars indicated on this form are the result of personnel with a research and extension joint appointment, where the research portion is paid on Hatch or Multistate Hatch funds.

Modifications to the Format of the Annual Report of Accomplishments and Results: Future Annual Reports will continue to highlight key planned projects, but we will not continue to designate these particular state experiment station projects in advance. Rather, we will choose projects that have been particularly successful in the diversity and scope of impact during the reporting year.

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[1]The resources indicated in this document are based on FY2001 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)

PA Agricultural Experiment Station
nnsylvania

: ___ **Multistate Extension Activities**
X **Integrated Activities (Hatch Act Funds)**
___ **Integrated Activities (Smith-Lever Act Funds)**

Actual Expenditures

of Planned Program/Activity	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
and Extension Personnel Appointments	$1,511,058	$1,509,013			
	$1,511,058	**$1,509,013**			

Bruce A McPheron

04/01/02

Bruce A. McPheron, Director **Date**
Appendix A

PA Agricultural Experiment Station