Feeding the Future

As a result of agricultural research, since 1980 agriculture has been the second most productive aspect of our economy. The research that’s been done over the last 30 years is nothing short of remarkable. It’s happening at Penn State, and it’s a result of partnerships between Penn State and government.”

U.S. Agriculture Secretary Tom Vilsack

The Future: Food for Thought

Agriculture—it touches every one of us every day. It provides us with food, fiber, wood, and energy. It impacts our health, our environment, and our communities, and it is a matter of national security. It is a leading economic driver in Pennsylvania, the nation, and the world.

As part of Pennsylvania’s sole land-grant institution, the Penn State College of Agricultural Sciences focuses on agricultural education, scientific research, and community outreach. With offices in each of the state’s 67 counties, Penn State Extension provides citizens with direct access to research-based educational programs and teams of experts that are charged to engage communities, assist businesses, and solve problems—addressing critical issues for Pennsylvania and the world. These valued programs are uniquely funded by a federal/state/county government partnership.

Food for Health

As the suffering and costs associated with issues such as obesity, diabetes, and heart disease continue to rise, the relationship between food and health becomes more important.

Penn State food scientists have found that exposing white button mushrooms to pulsed ultraviolet light can increase levels of the antioxidant vitamin D, a nutrient that helps prevent cancer, cardiovascular disease, and other ailments. Researchers also are looking for better ways to fortify dairy products with probiotic microbes that can enhance health, and others are studying the biology and genetics of taste, which could help make healthier foods the preferred choice of consumers.

For food to impart health benefits, it also must be safe. Researchers are creating sensors to detect pathogens during processing, as well as techniques such as edible antimicrobial films and pulsed ultraviolet light to inactivate them. Scientists also are developing DNA “fingerprinting” methods for identifying and tracking outbreaks of foodborne pathogens so they can be stopped at the source and prevented in the future.

Tackling Today’s Challenges

A Proven Infrastructure

In fall 2014, the invasive spotted lanternfly was discovered for the first time in the United States in Berks County. This insect attacks woody plants, threatening important agricultural sectors such as the grape, nursery, and hardwood industries. The state Department of Agriculture quickly
called on Penn State Extension to partner in efforts to monitor for the pest and educate growers and the public. Penn State entomology researchers also joined a USDA task force to study the spotted lanternfly, with an eye toward developing management strategies that can help stop this potential threat to the state’s agricultural economy.

Such disease and pest outbreaks affecting humans, animals, and plants can arise at any time—whether it’s the brown marmorated stink bug, which has caused millions of dollars in crop damage, or honey bee diseases that threaten the pollination needed to produce about a third of our diet. Rapid and effective response to these potential crises requires scientific knowledge, well-equipped facilities, and experienced teams of experts. It takes an ongoing commitment of resources to support the research that makes it possible to solve both short- and long-term problems, as well as an established network to apply this knowledge in the field.

Healthy Animals, Healthy People
Researchers in the college are studying the connection between immune cells and the ovarian tissue that produces progesterone in dairy cows. The goal: to increase healthy, full-term births.

Understanding how these cells work together to increase successful pregnancies could help dairy farmers maintain high milk production, reduce costs, and increase profitability on their farms. But this research has implications for human health as well. Since the reproductive systems of cows are models for those of people, knowledge gained about animals could have benefits for human fertility.

A novel method of altering a protein in milk to bind with an antiretroviral drug promises to greatly improve treatment for infants and young children suffering from HIV/AIDS, researchers in the College of Agricultural Sciences have found. That’s critical because the World Health Organization estimates that 3.4 million children are living with HIV/AIDS, and 9 out of 10 of them live in countries where effective antiretroviral treatments still are not widely accessible or available.

College researchers Sandeep Prabhu and Robert Paulson combined their expertise to make a discovery that could lead to a cure for leukemia. They found that a compound produced from fish oil selectively kills leukemia stem cells in mice. The mice in their study were completely cured of leukemia with no relapse. The researchers, who applied for a patent, are preparing to test the compound in human trials.

Putting Knowledge to Work
Research is at its most powerful when the knowledge it generates can be applied to solve current problems. Research and extension programs in the College of Agricultural Sciences play an important role in addressing emerging issues of critical importance to Pennsylvania.

Protecting Water Quality
More than half of Pennsylvania’s land drains to the Chesapeake Bay. President Obama’s 2009 executive order directed at restoring the bay has led to the development and enforcement of water quality regulations that could have a profound effect on the state.

Researchers and extension educators are helping agricultural producers adopt methods—related to soil fertility, tillage, animal nutrition, manure management, stream protection, and other best management practices—that reduce the flow of excess nutrients into ground- and surface water. One Penn State initiative, promoting precision feed formulation for dairy cattle, can reduce the amount of excess manure nitrogen and phosphorus by 50 percent or more, according to the Chesapeake Bay Commission.

Penn State Extension is bringing together diverse stakeholders in a community-based model to clean up local waterways such as the impaired Conewago Creek, which is a tributary of the Susquehanna River and Chesapeake Bay. Since the project began, farmers, municipalities, and other landowners in the watershed have increased conservation measures significantly, helping lead to measurable improvements in water quality. The project was cited as a “showcase watershed” by USDA’s Natural Resources Conservation Service (NRCS).

The college’s Center for Nutrient Solutions is funded by the Environmental Protection Agency and focuses on providing scientific knowledge to ensure that the right practices are implemented in the right places in a cost-effective manner, while developing strategies to address systemwide nutrient balance issues.

Stormwater can lead to flooding, cause runoff and pollution, and in many communities overwhelm water treatment facilities, resulting in overflow of sewage. Upgrading water treatment facilities can be cost prohibitive. That’s why researchers and extension educators in the college are partnering with community and environmental groups, municipalities, and others to design and install green infrastructure that can mitigate the effects of stormwater while saving communities money.

In the greater Pittsburgh area, Penn State Extension collaborated to offer workshops and technical assistance for
municipalities, institutions, and nonprofits on stormwater management best practices, such as riparian buffers, preservation of trees in construction sites, rainwater harvesting, permeable paving, bioswales, rain gardens, and green roofs. Extension staff in Philadelphia recently worked with students and volunteers to rebuild two green infrastructure sites: a rain garden and a stormwater bumpout. These features are capturing and absorbing stormwater and decreasing polluted runoff while beautifying the cityscape.

Growing Jobs and the Economy

Economic Impacts: Pennsylvania Agriculture Is Growing

Bucking the trend of other industries, agriculture is growing. The 2012 Census of Agriculture in Pennsylvania showed a 28 percent growth in the market value of production ($7.4 billion) since 2007. That doesn’t include another $5.5 billion for forest products. The college fosters that growth by providing science-based information and best practices to address issues ranging from efficiency and productivity, to food handling and safety, to environmental and regulatory compliance. Impacts can come in various forms:

Efficiency and Cost Savings

Tomato producers in Pennsylvania credit our ability to predict and respond to insect and disease threats with saving them $10 million in one year alone.

Regulatory Compliance

Under the 2011 Food Safety Modernization Act, the Food and Drug Administration (FDA) has developed new produce growing and handling standards. In addition, many supermarket chains and other commercial produce buyers require growers to show that they comply with on-farm food safety standards known as good agricultural practices, or GAPs. The cost to producers who implement GAP programs can be significant and could threaten their livelihood.

Penn State Extension has worked in collaboration with local food hubs—including produce auctions, cooperatives, distributors, and grocery store chains—to deliver GAP workshops for thousands of growers across the state. By completing the training, these growers gained the knowledge and skills needed to comply with GAP standards, which will help them maintain profitable marketing channels, protect the health of consumers, and comply with the FDA regulations.

In 2013, Penn State Extension provided ServSafe training to more than 2,100 employees of retail food service operations that serve about 1.2 million customers each week, helping those establishments meet state requirements for food safety certification.

Business Management

Having the right business knowledge and skills can be the difference between success and failure. Penn State Extension offers a range of educational resources—from workshops to publications to websites—to help business owners manage their enterprises effectively and profitably.

“We advise all of our members to attend Penn State Extension business management workshops, and we reward them for doing so with lower interest rates on business loans,” said Darrell Curtis, president and CEO of AgChoice Farm Credit.

“We advise all of our members to attend Penn State Extension business management workshops, and we reward them for doing so with lower interest rates on business loans.

The strategic information taught in these workshops is invaluable for business owners and enhances their likelihood of success.”

Darrell Curtis, President and CEO, AgChoice Farm Credit

Cost Avoidance

Penn State Extension administers proactive programs that help avoid remediation costs to society—such as Pennsylvania 4-H, which annually helps more than 100,000 youths develop leadership and citizenship skills. Research suggests that the PROSPER program, aimed at helping youth avoid substance abuse and other behavioral problems, saves communities more than $9 in treatment and other costs for every $1 invested. Programs that teach healthy lifestyles can help improve health outcomes and reduce healthcare costs. Extension also trains thousands of volunteers—more than 9,000 in 4-H alone—who log hundreds of thousands of hours each year of volunteer service benefiting the Commonwealth.

Nurturing New Industries

A project funded by a USDA grant is working to create jobs and help the Northeast lead the way to a renewable-energy-based economy by utilizing marginal and abandoned land to grow energy crops. The Northeast Woody/Warm-season Biomass Consortium is developing perennial...
feedstock production systems and supply chains for shrub willow—a short-rotation woody crop—and the warm-season grasses switchgrass and miscanthus. “This region’s landscape is dominated by rural communities suffering from decades of decline,” said project director Tom Richard. “Biomass energy could provide the social, economic, and ecological drivers for a sustainable rural renaissance.”

**Help with Trade Issues**
Pennsylvania is home to hundreds of wooden pallet/container companies. When the European Union (EU) required that wood packaging materials entering member countries be free from bark, the National Wooden Pallet and Container Association commissioned College of Agricultural Sciences researchers to conduct a study assessing the resulting economic impact on the U.S. solid wood packaging industry.

“My industry, with support from USDA, the U.S. Commerce Department, and the Office of the U.S. Trade Representative, had been addressing this issue with growing frustration,” said Bruce Scholnick, past president of the association. “This highly regarded research study clearly contributed to the EU decision to further explore and ultimately modify their bark-free position. Savings to my industry and the customers they service is measured in billions of dollars.”

**Encouraging Entrepreneurship**
Fostering entrepreneurship and the promise it holds for new jobs and economic development is the goal of the college’s Entrepreneurship and Innovation Initiative, which focuses on commercialization of faculty research and development of an entrepreneurial attitude among students.

Taking advantage of this initiative, researchers in the college developed a new piece of machinery, the Penn State Interseeder, which enables farmers to plant cover crops into growing corn and soybeans while applying starter fertilizer and preemergent herbicide, all in one pass of the field. The technology, which already is enjoying commercial success, can save growers time and money and help establish cover crops that can reduce soil nutrient loss and improve water quality.

To fight a resurgence of bed bugs in the United States and Europe, researchers in the college’s Department of Entomology developed a patent-pending, nontoxic biopesticide that can successfully eliminate and prevent bed bug infestations in homes and hotel rooms. The product, which has garnered strong interest from the lodging industry, is aimed at a market estimated at about $11 billion.

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