

2007 Michigan State University Combined Research and Extension Annual Report

Executive Summary

Report Overview

Michigan State University (MSU), the state's land-grant institution, is charged with generating research-based knowledge and educational programs people can access to make informed decisions to improve their lives.

The mission of the Michigan Agricultural Experiment Station (MAES) is to generate knowledge through strategic research to enhance agriculture, natural resources, and families and communities in Michigan. The MAES strives to maintain a balance between basic and applied research and relies heavily on the input of its constituents in identifying research priorities. The accomplishments and discoveries outlined in this report are reflective of the reason why MAES continues to be one of the most successful agricultural experiment stations in the country.

Michigan State University Extension (MSUE) helps people improve their lives through an educational process that applies knowledge to critical issues, needs and opportunities.

The success and accomplishments of the MAES and MSUE are fueled by close ties with each other as well as linkages to state agencies, commodity groups and other stakeholders, and outstanding legislative support.

MAES Research 2007 Quick Facts:

- 179 researchers representing 83 FTEs
- 252 active projects
- 14 patents awarded (10 U.S., 3 Korean, 1 Bulgarian)
- Dozens of patent applications submitted
- 270 peer-reviewed publications

Key research accomplishments for 2007 include:

- **Protecting Plant Productivity during Drought Stress:** The discovery of a gene that confers drought tolerance through regulating abscisic acid -- one of the plant hormones

responsible for transpiration levels -- laying the groundwork for new and enhanced stress-tolerant plant lines.

- **Jaz(zing) Up Plant Resistance:** The discovery of the family of proteins critical to plants receiving and responding to signals to defend themselves from diseases and insects and developed a model for how this interaction works. This study represents a significant advance in the understanding of a major plant hormone and how it works. The hope is to be able to either genetically modify plants or develop compounds that mimic this key plant hormone.
- **Breeding New Biofuel Crops:** The identification of a regulatory gene that signals the expression of the genes required to convert sugars into the building blocks of fatty acids, the main ingredient of oil. MEAS researchers are currently working on transferring the gene to the rutabaga plant to develop a rutabaga line that produces more oil and increasing the oil content in the leaves of other plants, such as canola, to maximize their use as bioenergy crops.
- **Breeding a Better Potato:** The release and adoption of a new line of scab-resistant chipping potato, progress on a series of chipping potato lines that combine scab and late blight resistance and the successful combination of conventional and genetically engineered late blight resistance.
- **Safeguarding Michigan's Asparagus Industry:** The development of new practices to safeguard Michigan's asparagus industry from *Phytophthora*, a devastating pathogen that attacks below-ground portions of the plant. Asparagus industry leaders are actively adopting these new practices to help turn the *Phytophthora* problem around. Practices include using crop rotations that reduce *Phytophthora* levels in asparagus fields, planting crowns from nursery fields that are pathogen-free, and remediating *Phytophthora*-infected fields so they can be put back into asparagus production.
- **Fighting Fire Blight Bacteria in Apples:** For the past five years, an MAES researcher and his colleagues at other universities have explored ways to limit the devastating effects of this economically crippling disease, which is becoming increasingly resistant to streptomycin -- the primary antibiotic used to combat the disease. The group has identified some promising biological control agents for fire blight bacteria in apple orchards. These materials could be registered for use by growers as early as 2008.
- **Developing Safer Insecticides for Fruit Fly Control:** The development of a new organic insecticide -- GF-120 -- a bait formulation that contains ammonium acetate -- to control fruit flies in orchards. Insecticides, such as GF-120, will protect fruit while safeguarding the environment and human health. Field testing will take place over the

next two years. The most successful products will be commercialized for widespread use.

- **Growing a More Efficient Nursery Production System:** The development of an effective growing media (an 80-20 mixture of pine bark and peat moss) that results in more efficient pot-in-pot nursery systems for trees. Several nurseries in Michigan have installed pot-in-pot systems or have expanded their production. Researchers are also conducting tests to identify the best nutrient regimes and fertilization. From this data, nutrient guidelines and diagnostic tools for key tree species will be developed.
- **Beefing Up Reproductive Management in Cattle:** The verification that variation in the numbers of follicles and eggs in ovaries is an important factor in cattle fertility. A large-scale fertility trial is underway to further verify the reliability of this data, determine if fertility is a genetically controlled trait and identify genetic or hormonal markers that identify calves with high reproductive potential at an early age. The goal is to select for high fertility during the breeding process to produce offspring with higher reproductive potential. This research also has applications to human fertility research for identifying markers for infertility and then developing therapies to correct them.
- **Engineering Food Safety for Processed Foods:** Pilot-scale studies on food safety of processed foods began in Spring 2007 in a newly-constructed biosafety processing plant at MSU to validate many of the models developed over the past five years. The goal of the program over the next three years is to create a tool for the meat processing industry to verify that their processes and products are safe.
- **Developing a New Approach to Wildlife Management:** MAES researchers have partnered with colleagues from the U.S. Fish and Wildlife Service, Cornell University and the Wildlife Management Institute to write a series of books for wildlife management professionals. The first book, *Thinking Like a Manager: Reflections on Wildlife Management*, was published in late 2006. The second book, on how to apply new wildlife management approaches is underway, and a third book on leadership in wildlife management is planned.
- **Improving Management Decisions Using Weather Data:** The launch of the MSU Enviro-weather information system, which integrates near-real-time data from 52 weather stations throughout the state with computer modeling projections to inform pest, natural resource and agricultural production management decision making in Michigan. The site is heavily used, averaging 41,650 hits a month, and a total of a half million hits in FY 2007.

- **Building a Better Mousetrap to Detect Food Allergens:** The development of a mouse-based model -- the first of its kind -- and are working to refine and validate the model so that it may be used to determine the allergenic potential of genetically engineered crops. The model could be available commercially within five years.
- **Improving Healthcare through Packaging:** The development of two new systems to develop healthcare packaging that is easier to access, particularly for aging consumers and people with disabilities. The systems are currently being calibrated and are scheduled to be fully operational in the next two to three years.
- **Working to Improve the Foster Care System:** The development and implementation of a new framework of principles -- Connections, Continuity, Dignity and Opportunity -- for the development of young people aging out of the foster care system.

MSUE 2007 Quick Facts:

- MSUE educated directly 410,085 participants (159,707 adults and 250,378 youth) in 83 counties.
- Through federal, state, county, and local partnerships, MSUE funding for 2006-07 was \$86.687 million with \$8.2 million being federal 3b&c funding. It is also true that the majority of all educational initiatives implemented by MSUE were from blended funding.
- In FY 2007, appropriated state and federal funds supported approximately 742 personnel. This corresponds to 401 FTE (full-time equivalents). With the additional funding obtained from county partners and other contracts and grants, MSU Extension employed 1,028 people, or 738 FTE. MSU Extension personnel serve in positions as faculty members, specialists, technicians, educators, program leaders, program associates, graduate assistants and clerical and administrative staff members. In addition to these personnel, Michigan counties employ another 238 FTE (280 people) personnel who work as part of our county Extension staff.

Key MSUE accomplishments for 2007 include:

- **Developing New Economic Opportunities:** Michigan's 21st Century Jobs Fund provided monies for 11 MSU research projects, from basic research to applied research that is already resulting in new Michigan companies. Several of the projects are aimed at boosting the bioeconomy, such as projects to develop ethanol fuel engines and research on a continuous production process for biodiesel. Michigan has three operational ethanol plants producing more than 140 million gallons of ethanol per year,

and two more are being constructed. Two biodiesel plants also are beginning production, and another is planned. MSU researchers estimate the total economic impact of the biodiesel plant in Bangor to be about \$95 million and that of the ethanol plant in Riga to be about \$75 million. MSUE and MAES educators and scientists helped the boards of directors of both facilities during the planning and startup phases. MSU's Product Center (funded by MSUE and MAES) has launched 50 ventures, 17 new businesses and 33 business expansions. These ventures created 310 jobs and had annual sales of \$41 million and a combined annual payroll of \$9.9 million.

- **Working to Improve Profitability for Dairy Farms:** The MSUE Dairy team is working with the MSU animal science department to improve and gain wider use of Ovsynch, a product that helps improve reproductive performance in Michigan dairy herds, thus increasing their profitability. The potential impact in Michigan from using Ovsynch to control calving interval and decrease reproductive culls could increase profits by more than \$20,000,000 per year, more than \$6,500 per farm.
- **Building Stronger Structures for Farms:** The Farm Management team helps Michigan farmers and agribusinesses make intergenerational transfers and avoid excessive estate taxes. MSUE educators also work with farm operations on income tax management to help ensure long-term profitability. Average savings were \$10,000 per farm for over 3,000 farmer trained.
- **Improving Farmers Access to Valuable Resources:** The USDA Natural Resources Conservation Service offers farmers technical and financial assistance to implement environmental protection practices. In 2002, Michigan farmers received \$6.8 million from EQIP funds to protect the state's waters and soils while limiting their need for purchased inputs. The MSU Integrated Pest Management Program began an effort to build awareness of available EQIP funds, and in 2006-07 farmers received \$15.1 million for such activities as converting to using pesticides with low pollution risk potential, using flamer/ steamer weed control methods, using organic mulches to suppress weeds and pests, and using disease inoculums reduction strategies.
- **Improving Biosecurity Practices:** MSUE held eight small poultry flock educational sessions across the state to inform more than 300 producers about biosecurity practices. About two-thirds of participants said they would change their management practices as a result of attending the program.
- **Improving Organic Agriculture Practices:** MSUE educators learned about soil quality, weed ecology and insect control, and MSUE specialists facilitated farmer-to-farmer hands-on training in organic agriculture practices through work aimed at

building capacity for developing local sustainable and organic farming systems. Forty-one percent of workshop participants, who represented 49,500 acres, said in a survey that they would reduce their use of herbicides for weed control that would result in savings of over \$400,000.

- **Protecting Michigan's Natural Resources:** Up to 10,000 wildfires damage Michigan homes and properties every year; 98 percent are caused by human behavior. MSUE has partnered with the Michigan Department of Natural Resources to produce Extension bulletins (in English and Spanish), a video, television PSAs that reached 300,000 northern and central Michigan households and a 30-minute educational documentary was released to PBS stations.
- **Improving the Environment Across Multi-states:** The 2006 Great Lakes Manure Handling Expo brought more than 1,300 visitors to Fowler, Mich. Farmers from 14 states and three Canadian provinces attended sessions on manure land application topics such as hauling costs, value of manure nutrients, odor, GPS technologies, composting, keeping manure out of tile drain systems and dealing with sand-laden manure. While the producers talked with exhibitors and MSUE educators, a program for state and local government officials gave them the chance to learn about current research and technologies in environmentally sound nutrient management strategies.
- **Improving the Health of Seniors:** Nearly 72,000 Senior Project FRESH coupons were redeemed by senior citizens for fresh produce sold at farm markets in 2007, resulting in \$142,388 in sales for local farmers and improved nutrition for seniors.
- **Improving the Health of Low-Income Families:** More than 28,000 WIC clients increased their intake of fruits and vegetables by using the 209,898 Project FRESH coupons distributed by MSUE Family & Consumer Sciences. Aside from the nutrition benefit to WIC clients, the coupons generated \$419,796 for Michigan farmers.
- **Working to Improve the Health of Michigan Families:** The MSUE Family & Consumer Sciences Nutrition Education Program enrolled nearly 10,000 individuals; 87 percent of adult graduates of the program report making positive changes in their eating habits, and 43 percent eat at least three servings of vegetables daily, compared with only 25 percent of Michigan adults in general.
- **Working to Improve the Outcomes for Infants:** Ninety-seven percent of women enrolled in the MSUE Family & Consumer Sciences breast-feeding Initiative initiated breast-feeding, compared with 49.7 percent of women in the overall WIC population. The state saves up to \$1,500 per year for every WIC-eligible mother who breast-feeds

rather than using formula. In addition, research has shown infants benefit from breastfeeding that include better health and attachment.

- **Building Stronger Communities:** Kids are True Conservation Heroes (KATCH), a 4-H environmental education program, launched 14 local projects in urban, suburban and rural areas throughout Michigan. Nearly 570 youth spent more than 4,400 hours working on these projects, which included riverbank restoration and cleanup, nest box placement and invasive plant control, and positively affected 1,540 acres of terrestrial habitat. Nearly 180 adults gave these projects 2,310 hours of volunteer time worth \$41,672. These projects attracted contributions of local goods and services valued at \$51,228 from 122 local partnering organizations.
- **Helping Youth on Future Careers:** Although many of the 250,378 Michigan youth who participated in 4-H in 2007 explored career options through their project work, nearly 25,000 engaged in specific career investigation/entrepreneurship activities through 4-H programs in critical thinking, economics, business and marketing.

Merit Review Process

The challenges facing Michigan agriculture and natural resources are increasingly complex and diverse. MAES research programs are continuously evaluated for relevance and progress. A strategic visioning process, linked to those of MAES-affiliated colleges at MSU (Agriculture and Natural Resources, Veterinary Medicine, Engineering, Social Science and Natural Science), has identified five strategic priority areas that will drive the MAES research agenda over the next decade. This process also involves industry experts, university faculty members and MSU Extension and Experiment Station Council members, and includes scientific review by peers (local, national and international) and industry experts. These target areas address the research priorities of Michigan agriculture and natural resources industries, but are also linked to national goals and new initiatives. The target areas are: Food and Health, Environmental Stewardship and Natural Resources Policy and Management, Enhancing Profitability in Agriculture and Natural Resources, Secure Food and Fiber System, and Families and Community Vitality.

MSUE uses several continuous processes that assist in setting priorities and evaluating program goals and plans. At the county level, the public, local government officials, advisory group members, extension council members, staff members and industry experts are involved in both the stakeholder process and review of the county and individual agents' plans. Each Area of Expertise (AoE) Team reviews the county needs, agents' plans, and research to

support these programs as well as others that may reflect emerging trends. In addition, the AoE goals are reviewed by state leaders and industry experts for quality and relevance. Collectively these plans are reviewed by MSUE and MAES directors who not only evaluate them, but use them in their regional and statewide presentations to describe future plans.

Jointly, MSUE and the MAES address issues of concern in local communities with research and teaching by using a network of citizen advisory groups at the local and state levels. County Extension councils identify and prioritize issues, seek collaborations and resources, and communicate to others the importance of Extension's educational programming. Citizen Advisory Councils help establish research priorities at the 15 MAES field research stations. The MSU Extension and Experiment Station Council serves as a liaison among county councils, field station advisory groups and state agencies and organizations.

Stakeholder Input

During 2005-2006, the MAES and MSUE completed a comprehensive statewide process: Strengthening Michigan's Economy: Roles for MAES and MSUE. Nearly 10,000 people took part in this issues identification process to help define future research and educational priorities for the two organizations. The five strategic priorities that emerged were: developing entrepreneurs, promoting healthy lifestyles, preparing for the expanding bioeconomy, educating and supporting decision makers, and building leaders for today and tomorrow.

In 2007, a variety of activities added to the leveraging of this process. The five strategic priorities were presented to and discussed with the joint MAES/MSUE state council at its spring and fall meetings.

At the fall MSUE meeting, members were asked to demonstrate how the educational and professional development programs being offered fit into the five priority areas and discussed how the process could be used to inform and guide education outreach, research and organizational infrastructure functions. During the fall 2008 conference, there will be five concurrent sessions -- one on each priority area -- to discuss and gain additional input.

Progress and revisions based on the five priorities are updated on a continuous basis at the county level. An aggregate county report for the past year is being prepared and will be presented to the state coalition in spring 2008. County staff also submits two partner reports a

year to highlight partnership efforts. These are used to customize information provided to county commissioners, state legislators or others who use MSUE/MAES information resources.

MSUE has contracted with the Institute for Public Policy and Social Research (IPPSR) to include questions related to the five priorities on its quarterly state of the state survey (SOSS) for the next three years. The first set of survey questions were sent out in fall 2007 and queried the general public about the five focus areas and what they thought about them. This data is in the process of being analyzed. The second set of questions is currently out in the field and asks questions about general household energy use and people's willingness to pay to conserve. This surveying will be a continuing source of information to help update and refine how critical issues are approached.

The results of Strengthening Michigan's Economy have also helped the MAES and MSUE's Area of Expertise teams do a better job of reporting what they've done and to inform future programming. The five priority areas are being used to better clarify and drive the organizations' programs and resources. This has also translated into asking those seeking internal resources to explain how their proposed project or program fits into one or more of the five priority areas.

Beginning in 2008, MSUE will initiate a major restructure by forming a new unit that combines its 4-H Youth and FCS programs. The major aim of the restructure is to better equip MSUE to determine how its education programs interact with citizens throughout their lifespan. This more consolidated approach will be organized around the priority areas within the broad unit of children, youth and families.

With a mission to generate knowledge through strategic research to enhance agriculture, natural resources, and families and communities in Michigan, the MAES has an extremely broad and long list of stakeholders. In reality, every Michigan citizen is an MAES and MSUE stakeholder.

The Strengthening Michigan's Economy process and ongoing efforts offer multiple ways for people in various roles and locations to help identify the issues and opportunities for MAES research and MSUE educational programming during the years ahead.

Statewide telephone surveys for the State of the State Survey (SOSS) and citizen focus groups were used to identify the major issues and opportunities in Michigan and assign a priority ranking to each. The use of SOSS quarterly surveys to gain insight and input into programming is being continued over the next three years.

A Web-based survey asked what people saw as the role for MAES and MSUE related to key issues and opportunities. Similar surveys may be developed and disseminated to seek additional input.

Community based discussions in all Michigan counties, involving the local MAES advisory committees, MSUE councils and others were held to discern what issues and opportunities these stakeholders believed should be addressed by MAES research and MSUE educational programs?

AoE Teams conducted subject-specific focus groups comprising a variety of stakeholders and continue to assess and revise their reporting and work.

Community groups, commodity and producer groups and other state and local partners were asked what specific issues and opportunities should be addressed by MAES research and MSUE educational programs.

The MAES/MSUE State Council responded to the question: "Looking at the results of the SOSS survey, what are the implications for MAES research and MSUE educational programming in the future?"

AoE co chairs representing 29 teams were asked to identify emerging issues and opportunities. Each team conducted stakeholder/constituent input sessions and reflected the results in their respective plans of work.

Faculty focus groups, with representatives from all MSU colleges and units, were held to learn faculty perceptions of emerging Michigan issues and opportunities and identify ways that MSU science might be used to address those issues and opportunities.

MSU faculty and MSUE/MAES staff surveys were used to develop a better understanding of MSU's ability to respond to the issues and opportunities identified in the faculty focus groups.

County teams, including MAES field station managers, synthesized and submitted local priorities identified by local MSUE councils and MAES advisory committees.

AoE teams synthesized and prioritized content specific program and research needs generated from input of their advisory bodies and continue to fine tune based on additional input combined with the 2005/2006 survey results.