MICHIGAN AGRICULTURAL EXPERIMENT STATION
ANNUAL REPORT
OCTOBER 1, 2000–SEPTEMBER 30, 2001

EXECUTIVE SUMMARY

The Annual Report for October 1, 2000, through September 30, 2001, for the Michigan Agricultural Experiment Station (MAES) includes a variety of research areas and is organized to mirror the Plan of Work. Following is an overview of the accomplishments and achievements of the past year.

The guiding principle of the Michigan Agricultural Experiment Station is "Research for Your Future," and for the MAES scientists, administrators, field station managers and staff members, preparing for that future began the day they joined the MAES. Emerging successes in programs and research allow the MAES to continue building on its solid foundation as it moves through the 21st century.

In the plant sciences, MAES scientist and plant molecular biologist Michael Thomashow was named the 2001 recipient of the Alexander von Humboldt Foundation Award. Thomashow is internationally recognized for his work on the molecular mechanisms of cold acclimation in plants. The Alexander von Humboldt Award is considered the most prestigious award for agricultural research in the United States.

Nutritional genomics, such as the work being done by MAES biochemist and molecular biologist Dean Della Penna, is addressing basic questions in the manipulation of vitamin E synthesis in a variety of agricultural crops. The answers to these questions can lead to methods for producing more plant foods nutritionally rich in vitamins, which can especially benefit countries where nutritional deficiencies are common.

The Michigan Agricultural Experiment Station has invested efforts in addressing the ongoing societal concerns in food safety through the National Food Safety and Toxicology Center at MSU, which plays an important role in developing new techniques to detect food-borne pathogens and prevent them from contaminating the food supply. The MAES also supports the development of a center for Emerging Infectious Diseases at Michigan State University. This center would monitor, prevent and control emerging infectious diseases in the state and serve as a model for national and international programs. This center also has the backing of several MSU departments and organizations and state officials in the departments of Agriculture, Natural Resources and Community Health.

The Michigan Life Sciences Corridor (MLSC), which is primarily made up of four of Michigan's research institutions -- MSU, Wayne State University, the University of Michigan and the Van Andel Institute -- has a mission to enhance, through collaboration, research in the life sciences and develop Michigan's biotechnology industries. Fourteen

grant proposals submitted by MSU researchers received funding in December 2000, including five by MAES faculty members

Successful projects within the Families and Communities Together (FACT) coalition, Project GREEEN (Generating Research and Extension for Economic and Environmental Needs) and the Animal Industry Initiative continue to provide Michigan producers and rural communities with better ways to live and work. As these programs and others with the MAES materialize, the MAES strives to maintain a balance between applied and basic research and appreciates the input of stakeholders toward the identification of research priorities and their funding of selected projects.

Problem solving with today's tools will not be sufficient to solve tomorrow's issues. The solid foundation of the MAES supports efforts to prepare for those issues now with strategic research that will ultimately improve the quality of life for Michigan's citizens.

Guide to Acronyms in This Report

AII	Animal Industry Initiative
CANR	College of Agriculture and Natural Resources
CAT	Crop Advisory Team
CEVL	Computational Ecology and Visualization Laboratory
CHM	College of Human Medicine
CNS	College of Natural Science
CPPT	Center for Plant Products and Technologies
CVM	College of Veterinary Medicine
FACT	Families and Children Together
FDA	Food and Drug Administration
FNDRC	Food and Nutrition Database Research Center
FQPA	Food Quality Protection Act
GCSAA	Golf Course Superintendents Association of America
GIS	Geographic Information Systems
GREEEN	Generating Research and Extension to meet Economic and Environmental Needs
GWP	Global Warming Potential
HACCP	Hazard Analysis Critical Control Point
IFAS	Institute of Food and Agricultural Standards
LTER	Long-Term Ecological Research
MAEAP	Michigan Agricultural Environmental Assurance Program
MAES	Michigan Agricultural Experiment Station
MDA	Michigan Department of Agriculture
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
MFB	Michigan Farm Bureau
MMP	Manure Management Planner
MNN	Michigan Nutrition Network
MSAC	Michigan Sugarbeet Advancement Committee
MSU	Michigan State University
MSUE	Michigan State University Extension
MTESP	Michigan Turfgrass Environmental Stewardship Program
NFSTC	National Food Safety and Toxicology Center
NEAT	Nutrition Education Aimed at Toddlers
NSF	National Science Foundation
PAR	Pesticides at Risk
PPV	Plum Pox Virus
POW	Plan of Work
TB	tuberculosis
TOPC	Thumb Oilseed Producers Cooperative
USDA	United States Department of Agriculture
VPRGS	Vice President for Research and Graduate Studies

GOAL 1: An Agricultural Production System That is Highly Competitive in the Global Economy

Summary

Agriculture adds nearly $40 billion to Michigan's economy. Food and agriculture make up the state's second most important – and most stable – industry, employing more than 500,000 people every year. In addition, forestry ranks as Michigan's third major industry, according to economic studies.

Agriculture in Michigan is impressively diverse. Michigan ranks third behind California and Florida in number of crops grown. Soybeans and corn are the No. 1 and 2 cash crops in the state. Surrounded by the Great Lakes, the state has ideal climate and soil conditions for floriculture, nursery and fruit crops in western Michigan. The Thumb provides model conditions for dry beans and sugar beets, while southeastern Michigan boasts large numbers of turf and nursery operations. The MDA reports that, in economic terms, Michigan ranks in the top five states for 35 crops. Our state is the No. 1 producer of several types of dry beans, blueberries, cucumbers for pickles, tart cherries, Easter lilies and summer potatoes. These specialty crops contribute to the state's agricultural strength, but they all require specific growing techniques and research.

According to the Michigan Department of Natural Resources, forests cover 53 percent of the land area of the state, or about 19.3 million acres. These forests are a critical component of Michigan's environment and economy for the recreational opportunities and the products they provide. Forestry related industries and manufacturing employ 150,000 people statewide and annually contribute $9 billion to the state's economy. Additionally, forest-based tourism and recreation support 50,000 jobs and add $3 billion to Michigan's economy. Michigan's forests contribute to clean air and water, and reduce soil erosion.

Allocated Resources:

Goal 1: An Agricultural Production System That is Highly Competitive in the Global Economy

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
Hatch Funds						
Hatch Regular	2,579,944	2,528,345	2,477,778	2,428,222	2,379,658	2,332,065
Multi-State Funds	521,064	521,064	521,064	521,064	521,064	521,064
Other CSREES Funds*	3,386,708	3,386,708	3,386,708	3,386,708	3,386,708	3,386,708
Other Federal Funds*	13,775,078	13,775,078	13,775,078	13,775,078	13,775,078	13,775,078
Total Federal Funds (est.)	20,262,794	20,211,195	20,160,628	20,111,073	20,062,508	20,014,915
State Match for Hatch Funds	3,101,008	3,049,409	2,998,842	2,949,286	2,900,722	2,853,129
Remaining State Appropriations	18,169,573	18,859,289	19,567,117	20,293,652	21,039,504	21,805,304
Self Generated Funds*	2,360,151	2,360,151	2,360,151	2,360,151	2,360,151	2,360,151
Industry Generated Funds*	4,387,668	4,387,668	4,387,668	4,387,668	4,387,668	4,387,668
Other Non-Federal Funds*	345,369	345,369	345,369	345,369	345,369	345,369

Total State Funds (est.)	28,363,76929,001,887	29,659,148	30,336,126	31,033,414	31,751,621
Total Estimated Funds	48,626,56349,213,082	49,819,776	50,447,199	51,095,923	51,766,536
Scientist Years	91.491.4	91.4	91.4	91.4	91.4

*Values extracted from Fiscal Year 2001 Funds and Manpower Report

1. MAES scientists, with input from the state's commodity groups, are working on many projects to ensure the continued competitiveness and robustness of Michigan agriculture and natural resources. Improving the sustainability of Michigan's potato industry.

A. Brief Description: Michigan's 50,000 acres of potatoes are worth more then $100 million annually. This precious crop is often infected with late blight, the No. 1 potato disease worldwide. When a new strain of the fungus that can tolerate higher temperatures and resist standard fungicides was discovered in Michigan, researchers joined together to look for solutions to stop more than $2 billion in crop losses worldwide.

The Colorado potato beetle is the major insect pest of potatoes in North America. Researchers have identified an insecticide with low mammalian toxicity and reduced environmental risk that uses less active ingredient to economically control the insect.

B. Accomplishment Statement: MSU researchers developed the 'Jacqueline Lee,' a new potato variety that combines strong resistance to this new strain of late blight (US8) with excellent tablestock qualities. Resistance has now been transferred into chip-processing advanced potato breeding lines, which are being distributed for statewide testing.

Using the new insecticide, active ingredient per pound use was cut by more than 350,000 pounds per year and potato losses were reduced by more than $4 million. The researchers are now working to create an integrated pest management system that incorporates a combination of engineered and natural plant pest resistances and biological control.

C. Source of Funding: see table for Goal 1.

D. Scope of Impact: MI, ND, MN, WI, MSUE

2. Developing new strategies to enhance the profitability of Michigan's blueberry industry.

A. Brief Description: Michigan is the world leader in blueberry production with production topping more than 55 million pounds worth more than $55 million annually.

B. Accomplishment Statement: Researchers are developing storage methods for fresh blueberries that may double or triple the profitability of Michigan's blueberry crop. Michigan fresh blueberries can command a premium price because no place else in the world is harvesting blueberries during early September through November. MSU developed two new late maturing varieties that have a longer storage capability and better fruit quality than the leading fruit cultivar. Researchers have also developed effective cultural approaches for disease and insect control while reducing chemical use. This will save growers thousands of dollars each year and improve fruit quality.

C. Source of Funding: see table for Goal 1.

D. Scope of Impact: MI, ME, NY, WI, MN, MSUE

3. Advanced technology applications for eastern hardwood utilization.

A. Brief Description: An enormous amount of wood is used in Michigan. Recycling of wood, wood products and sawdust created by furniture makers and the forestry industry is a major issue tackled by researchers in an effort to reduce the cost – currently upwards of $2 million -- of disposing of these products as well as chemically treated wood.

B. Accomplishment Statement: Researchers have recycled wood particles and sawdust from housing demolitions, mixed it with plastic and created a new product used for window frames and siding. Cost of this value-added product is $.05 per pound compared to 30 cents per pound for straight plastic. This technology has been licensed to Michigan corporations for creating composite lumber (wood and plastic).

Research has discovered a method to recycle plastic with wood sawdust to make cheaper product with the same durability as plastic. In the future, this method can be used with any type of cellulose material, such as cornstalks or wheat straw, in recycled plastic products.

A method to extract copper chrome arsenic from pressure-treated wood has been developed so the wood can be recycled according to EPA guidelines.

Wood finishes with ultraviolet light protection have been developed by researchers to aid furniture manufacturers, who find it economically advantageous that wood finishes absorb light and do not change color or fade from light exposure.

C. Source of Funding: see table for Goal 1.

D. Scope of Impact: MI, WI, MN, Centers for African, Asian, and Latin America at MSU, NY, USDA/Forest Service, MDNR, Lake States Forestry Alliance, OH, IL, PA, Weyerhaeuser, Inc., Paper & Pulp Industries, Ont., Sauder Woodworking Co., MS, FL, CA, WV, Food Products Society, U of Alaska at Fairbanks, Mississippi State, Oregon, U of Tenn., NC State, U of Maine, U of Minn., Inter-mountain Group (Idaho and Montana), Universal Forest Products, Merillat, Georgia Pacific, U.S. Forest Service, MI Tech, VPI, Syracuse, Pulp Paper Company

GOAL 2: A Safe and Secure Food and Fiber System

Summary

Food safety has always been a significant issue in the United States, but in the past decade it has taken on new importance. We live in a global community and food products come from all over the world. This has created a need to monitor and check foodstuffs before and after they are shipped, not only between U.S. regions but from country to country as well. *E. coli 0157:H7,* hepatitis A, *Campylobacter jejuni* and *Cyclospora* are just a few of the food-borne pathogens that have had serious effects on human lives here and abroad. MAES scientists have developed the tools to detect these pathogens before they infect the population.

Diseases and pests affect human food supplies as well by jeopardizing the plants and animals that supply the food. In Michigan, the focus has been on eliminating bovine tuberculosis and keeping plum pox virus out of the state. These diseases threaten to infect, damage or eliminate entire food crops or animal herds. Being proactive and vigilant with relevant research, education and implementation is key to controlling these problems.

Allocated Resources:

Goal 2: A Safe and Secure Food and Fiber System

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
Hatch Funds						
Hatch Regular	245,257	252,868	261,839	270,630	279,245	287,687
Multi-State Funds	120,070	120,070	120,070	120,070	120,070	120,070
Other CSREES Funds*	376,620	376,620	376,620	376,620	376,620	376,620
Other Federal Funds*	5,044,120	5,044,120	5,044,120	5,044,120	5,044,120	5,044,120
Total Federal Funds (est.)	5,786,067	5,793,678	5,802,649	5,811,440	5,820,055	5,828,498
State Match for Hatch Funds	365,328	372,939	381,909	390,700	399,315	407,758
Remaining State Appropriations	2,707,109	2,791,672	2,877,640	2,966,635	3,058,740	3,154,039
Self Generated Funds*	39,756	39,756	39,756	39,756	39,756	39,756
Industry Generated Funds*	714,603	714,603	714,603	714,603	714,603	714,603
Other Non-Federal Funds*	242,786	242,786	242,786	242,786	242,786	242,786
Total State Funds (est.)	4,069,582	4,161,755	4,256,693	4,354,480	4,455,200	4,558,941
Total Estimated Funds	9,855,649	9,955,433	10,059,342	10,165,919	10,275,254	10,387,439
Scientist Years	13.0	13.0	13.0	13.0	13.0	13.0

*Values extracted from Fiscal Year 2001 Funds and Manpower Report

1. Soybean aphid: A new invasive pest in soybean production.

A. Brief Description: Soybean aphids were first found in Michigan in 2000. The discovery late in the season meant that little information was collected on the impact of this new pest. However, in 2001, researchers sampled the putative overwintering host, buckthorn, for aphid eggs. Though no eggs were found then, female aphids were found on buckthorn leaves the following spring. Through the field season data was collected and evaluated to determine distribution in the state.

B. Accomplishment Statement: Soybean aphid is an invasive species that jeopardizes our food supply. The fact that Michigan had some of the most dramatic soybean aphid populations in 2001 allowed us to generate some of the best data on the impact of the pest in the country. Researchers have developed a checklist that will be used as a guideline for soybean growers for making and timing treatments in 2002.

C. Source of Funding: see table for Goal 2.

D. Scope of Impact: MI, WI, MN, IA, IL, IN, OH, Ont., MSUE

2. Epidemiological study compares cattle farms that may be infected with bovine tuberculosis by deer populations.

A. Brief Description: This study compared factors associated with the increased risk for TB. Researchers found increased risk in areas where cattle housing or cattle feed on the farm was more accessible or attractive to deer, such as areas with poor fencing or the presence of ponds or streams in pastures.

B. Accomplishment Statement: This information is critical in developing risk assessment models for bovine TB in cattle, economic impact models and cattle industry risk analysis. Specific management factors identified in this study will be used to develop farm TB control programs.

C. Source of Funding: see table for Goal 2.

D. Scope of Impact: TX, MI, MDA, USDA, IN, OH, NY, PA

3. Protecting our borders and ensuring an import/export market for stone fruit trees.

A. Brief Description: The pesticide and plant pest management export manager and a plant pest specialist at the Michigan Department of Agriculture work to ensure that food and related products arriving and leaving the state are healthy and safe for consumers. These positions are

partially funded by the plant agriculture initiative at Michigan State University. Michigan nurseries supply the majority of stone fruit trees for orchards in states east of the Mississippi River and Canada. MDA staffers work closely with stone fruit nurseries and the USDA-APHIS to resolve intra- and interstate trade issues associated with plum pox virus (PPV).

B. Accomplishment Statement: The Canadian stone fruit nursery market, which adds more than $500,000 per year to the state's economy, was reestablished in 2001 after its two-year ban on stone fruits and fruit nursery stock from Michigan. Extensive testing of fruit trees in Michigan during 1999 and 2000 proved PPV was not in the state.

C. Source of Funding: see table for Goal 2.

D. Scope of Impact: MI, PA, Ont., NY, APHIS, MDA, MSUE

4. Early detection of pathogenic contamination in packaged plant food products

A. Brief Description: In 1996, the USDA Food Safety and Inspection Service (FSIS) mandated requirements in an effort to reduce the occurrence and numbers of pathogens on meat and poultry products, reduce the incidence of food-borne illness associated with consuming these products, and provide a framework for modernization of the meat and poultry inspection system. This effort has expanded into fresh vegetable and fruit products.

B. Accomplishment Statement: Three sensors have been developed to detect pathogens in food: **conductimetric biosensor**, which detects *E. coli O157:H7* in water and food, such as milk, apple cider, and vegetables; **chemiluminescence**, which utilizes light emission as a to reveal contamination by such bacteria as E. coli and Salmonella in fresh fruits and vegetables; and the **electronic nose**, or e-nose, a "sniffer" for the early detection of bacterial contaminants. The e-nose can differentiate unique gas patterns generated by *E. coli* O157:H7 and non-pathogenic *E. coli* in pure culture, *Erwinia carotovora* bacteria in potato tubers before any visible symptom can be observed externally, *Staphylococcus aureus* in fermented sausages, as well as *Salmonella* and *E. coli* contamination in packaged plant food products. Marketing of these sensors for use by food safety organizations is being investigated.

C. Source of Funding: see table for Goal 2

D. Scope of Impact: national and international implications, MSUE, MDA, USDA, Department of Community Health

GOAL 3: A Healthy, Well-Nourished Population

Summary

A healthy start to the day includes breakfast, according to studies done by MAES researchers. In collaboration with schools, Extension specialists and community organizations, a program promoting breakfast among pre-teens and teen-agers in three Michigan counties increased the awareness of the importance of eating breakfast, and 12 percent more students ate breakfast after the program was offered than before.

The importance of eating a well balanced diet throughout life is emphasized in projects conducted by MAES researchers. How do you get parents' and children's attention to think about good nutrition? How do you educate them about good nutrition? What will motivate them to incorporate good nutritional habits into their lives? Implementing the answers to these and other questions could make a significant impact on the health of Michiganians, with national and global implications.

Allocated Resources

Goal 3: A Healthy, Well Nourished Population

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
Hatch Funds						
Hatch Regular	36,925	38,071	39,421	40,745	42,042	43,313
Multi-State Funds	41,225	41,225	41,225	41,225	41,225	41,225
Other CSREES Funds*	66,171	66,171	66,171	66,171	66,171	66,171
Other Federal Funds*	1,065,782	1,065,782	1,065,782	1,065,782	1,065,782	1,065,782
Total Federal Funds (est.)	1,210,102	1,211,248	1,212,599	1,213,922	1,215,219	1,216,490
State Match for Hatch Funds	78,150	79,296	80,646	81,970	83,267	84,538
Remaining State Appropriations	1,061,497	1,094,541	1,128,405	1,163,353	1,199,416	1,236,625
Self Generated Funds*	0	0	0	0	0	0
Industry Generated Funds*	410,969	410,969	410,969	410,969	410,969	410,969
Other Non-Federal Funds*	140,141	140,141	140,141	140,141	140,141	140,141
Total State Funds (est.)	1,690,757	1,724,946	1,760,162	1,796,433	1,833,793	1,872,273
Total Estimated Funds	2,900,859	2,936,195	2,972,760	3,010,355	3,049,012	3,088,764
Scientist Years	6.3	6.3	6.3	6.3	6.3	6.3

*Values extracted from Fiscal Year 2001 Funds and Manpower Report

1. Using stage-based interventions to increase fruit and vegetable intake in young adults.

A. Brief Description: In an ongoing study, researchers in Michigan and Oregon are assessing methods to deliver a sustained, six-month stage-tailored intervention designed to increase consumption of vegetables and fruits tailored for diverse populations of young adults. They would then

test the effectiveness of the intervention by comparing the target group to a non-treatment control group.

B. Accomplishments: Color newsletters were the preferred method over e-mail in providing information about food choice change to the young adults in the study.
A national sample of 13,600 adolescents was analyzed to examine weight control practices and fruit and vegetable intake. Findings indicated that average weight youth were those most likely to practice vomiting and laxative abuse, and those who used weight control were less likely to eat five fruits and vegetables, drink milk once a day, or eat a variety of food. In a study of 360 college students' three day lists of dietary intakes, only 42 percent consumed two servings of fruit and 47 percent averaged three daily servings of vegetables. This information will be used in the creation of interventions to increase fruit and vegetable consumption.

C. Source of Funding: see table for Goal 3.

D. Scope of Impact: MI, NE, OR, RI, NY, KS, WI, IA, AL, SD, ME, CHE, MSUE

2. Michigan Nutrition Network: Eat Healthy, Eat Breakfast.

A. Brief Description: The Michigan Nutrition Network (MNN) recently completed the "Eat Healthy, Eat Breakfast" campaign, a research-based campaign in Clinton, Eaton and Ingham counties to improve breakfast eating and, ultimately, school performance and overall health among teens.

B. Accomplishment Statement: This campaign increased breakfast eating among kids aged 11-15. An estimated 212,010 people in Michigan were exposed to the campaign, through schools, media and community activities. The campaign had more than 200 community partners, brought participation from over 70 schools and major grocery stores in the area. At one middle school, breakfast consumption by 11-to 15-year-olds increased by 12 percent. Students there reported fewer headaches, stomachaches, light-headedness or general malaise later in the day than those who did not eat breakfast. Eating breakfast increased the likelihood of being free of these complaints by 32 percent.

C. Source of Funding: see table for Goal 3.

D. Scope of Impact: MSUE, Mich. Dept. of Community Health, Kroger, Meijer, MDOE, United Dairy Indep. of MI, HEADSTART

3. Youth development through physical activity and nutrition education.

A. Brief Description: This was a pilot program developed to help improve the skill development, self-esteem and nutritional behaviors of third through sixth graders enrolled in an after school program in the Lansing, Mich., area.

Accomplishment Statements: 16 children in third through fifth grades attended nutrition activities once per week and instruction in fitness and skill twice a week. Twenty-three sixth graders participated in nutrition education once per week and instruction in tae kwon do once per week.

Significant differences were seen in pre to post tests in three areas:
Trunk lift (measure of back flexibility)
Object control skills (striking, dribbling, kicking, overhand throwing)
Locomotor skills

For sixth grade girls, no statistical difference on Harter's Perceived Competence Sub scale was seen, but two items were moving in the right direction – close friend ship and self-worth.

Another pilot project called "Jump Into Foods and Fitness" will be integrating the data from this study with nutritional data toward improving the health and fitness of students enrolled in after school programs.

C. Source of Funding: see table for Goal 3.

D. Scope of impact: YMCA, MDOE, Ingham Intermediate School District, MSUE, FACT.

GOAL 4: Greater Harmony Between Agriculture and the Environment

Summary

In the mid-1980s, the term *sustainable agriculture* became commonplace in discussions among growers and researchers. Although it can mean many things to many people, most would agree that sustainable agriculture refers to an agricultural system that provides producers with a just income, provides consumers with a dependable, safe, nutritious food supply, and has minimal negative impact on the environment. It means understanding the various systems well enough to manage and integrate them.

It is important to know that there is not just one sustainable agriculture program at MSU that includes some projects and excludes others. Biological integration is a theme that runs through many MAES programs and is important to everyone. Scientists are looking for methods to control plant diseases by boosting the plants' own defense mechanisms and lowering the use of antibiotics that bacteria are becoming resistant to.

Working with the environment to find solutions to pest and disease problems is an ecologically sound method of producing food, and both researchers and producers are building on and embracing these new strategies.

Allocated Resources

Goal 4: Greater Harmony Between Agriculture and the Environment

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
Hatch Funds						
Hatch Regular	891,916	919,594	952,216	984,185	1,015,515	1,046,219
Multi-State Funds	213,044	213,044	213,044	213,044	213,044	213,044
Other CSREES Funds*	642,418	642,418	642,418	642,418	642,418	642,418
Other Federal Funds*	7,468,848	7,468,848	7,468,848	7,468,848	7,468,848	7,468,848
Total Federal Funds (est.)	9,216,226	9,243,904	9,276,526	9,308,495	9,339,826	9,370,529
State Match for Hatch Funds	1,104,959	1,132,637	1,165,259	1,197,229	1,228,559	1,259,262
Remaining State Appropriations	5,982,916	6,167,874	6,354,267	6,547,883	6,748,907	6,957,527
Self Generated Funds*	291,555	291,555	291,555	291,555	291,555	291,555
Industry Generated Funds*	3,027,129	3,027,129	3,027,129	3,027,129	3,027,129	3,027,129
Other Non-Federal Funds*	414,845	414,845	414,845	414,845	414,845	414,845
Total State Funds (est.)	10,821,403	11,034,039	11,253,055	11,478,640	11,710,994	11,950,318
Total Estimated Funds	20,037,629	20,277,943	20,529,581	20,787,136	21,050,819	21,320,847
Scientist Years	40.3	40.3	40.3	40.3	40.3	40.3

*Values extracted from Fiscal Year 2001 Funds and Manpower Report

1. Protecting orchards from fire blight bacterium.

A. Brief Description: Michigan State University is taking aggressive measures against fire blight. This bacterial disease, a major threat to Michigan's apple trees, occurred in epidemic proportions in 2000.

B. Accomplishment Statements: Researchers determined how to boost an apple tree's natural resistance to fire blight through the use of a compound closely resembling common aspirin. They have determined the best application rate and frequency for the compound and application timing for disease control. In 2001, MSU scientists found that enhancing host resistance allowed other treatments to control blight better. These studies will aid in the eventual registration and use of this novel approach to control the disease and reduce the need for antibiotics.

Researchers also developed a new plant growth retardant compound to reduce the period when new growth is susceptible to fire blight. The EPA registered prohexadione calcium for use in 2000. Better season long control of fire blight was seen in 2001 when the growth retardant strategy was used with the standard antibiotics early in the growing season. Another study molecularly grouped the diverse strains of the fire blight pathogen on the basis of geographic origin and the origin of the host. These studies are important to selecting cultivars and rootstocks with durable resistance, identifying possible sources of infection and timing control methods when the pathogen is present. MSU scientists have documented some of the similarities and differences between fire blight pathogen and other bacteria that cause similar symptoms on some fruit crops.

To slow the spread of resistant fire blight bacteria resistant to streptomycin, MSU scientists encouraged growers to avoid unnecessary streptomycin sprays and substitute oxytetracycline where possible.

C. Source of Funding: see table for Goal 4.

D. Scope of Impact: MSUE, MDA, NY, PA, VA, IN, OH, MI

2. Safeguarding the supply of fruit for consumers.

A. Brief Description: A variety of research projects conducted by a team of MAES scientists will help growers continue to produce high-quality fruit in an environmentally sound manner.

B. Accomplishment Statement: Researchers developed two natural repellents for the fruit pest plum curculio. Further tests will determine their efficiency.

Another study discovered a new blueberry maggot fly control using biodegradable or wooden spheres treated with insecticides. This novel, risk-reducing technology is now being registered.

Scientists found that methoxyfenozide, a new insect growth regulator, controls leafroller pests without harming the pests' natural enemies.

Researchers also developed systems to trap eastern cherry fruit flies and plum curculio using chemical attractants.

C. Source of Funding: see table for Goal 4.

D. Scope of Impact: MI, MDA, MSUE, NY, WI, MN, IN, OH, PA, VA, Chili, New Zealand

3. Increasing environmental stability of sugar beets.

A. Brief Description: A variety of research projects conducted by a team of MAES scientists will help growers continue to produce high-quality sugar beets in an environmentally sound manner.

B. Accomplishment Statement: Scientists encouraged producers to adopt tillage practices to improve plant emergence. Growers are also modifying management practices to conserve soil moisture where the seeds are planted.

Studies demonstrated the beneficial results of using a strobolin class of fungicides for diseases such as *Rhyzoctonia* crown and root rot.

C. Source of Funding: see table for Goal 4.

D. Scope of Impact: MI, OH, Ont., MSUE

4. Sustainable agriculture 2001: ecologically based farming.

A. Brief Description: Sustainable agriculture helps farmers manage their crops for excellent yields and reduced fertilizer and pesticide use and stem nutrient losses to ground and surface water. This research has been a springboard for other ecological research at MSU designed to interpret and apply the findings to Michigan's production systems.

B. Accomplishment Statement: Several Extension bulletins/books that apply a broad range of agronomic and horticultural systems have been created and distributed, leading to an increasing knowledge base of producers embracing sustainable agricultural practices, including innovative farmers, Extension staff members, students and other researchers.

Reduced tillage methods reduced soil loss to less than half the usual 5.5 tons per acre in sugarbeet production. Moldboard plowing in sugar beets is becoming a thing of the past. One of Michigan's largest growers uses reduced tillage with cover crops and manure on most of his 2,500 beet acreage, setting a standard for soil quality and yield.

MSU issued soil quality nematode management guidelines to Michigan sugar beet growers. In 2001, the MSU diagnostics laboratory was one of the nation's first to offer a nematode population analysis as a guide to assessing soil quality. MAES researchers are now presenting information nationwide about this trend-setting effort in pest ecology.

C. Source of Funding: see table for Goal 4.

D. Scope of Impact: State specific with national and international implications

5. Improving water quality in landscape plant production.

A. Brief Description: Michigan's $250 million nursery and landscape plant industry ranks fifth in the nation. Concern about water runoff and surface water contamination from container production systems and groundwater contamination from field nurseries prompted MSU researchers to devise more efficient management strategies to benefit the environment and reduce production costs for growers. Reducing pesticide levels in recycled irrigation water from container systems is expected to result in improved plant and off-site water quality.

B. Accomplishment Statements: Several marketable nursery plants were identified as effective filters for removing chemicals from runoff water in field nurseries, thus making more land available for nursery plant production.

Wulpak , a self-felting wool pellet, permitted reduced pesticide use while increasing plant growth, thereby increasing the value of Michigan nursery crops.

C. Source of Funding: see table for Goal 4.

D. Scope of Impact: Landscape and nursery industry, national implications, FL, MN, NY, NC, MI

6. A national agricultural program to clear pest control agents for minor uses.

A. Brief Description: To support the registration of minor-use pesticide needs, the North Central region completed 112 reports for food use field

trials and 87 residual trials and sent them to IR-4 headquarters at Rutgers University. More are in the works.

B. Accomplishment Statement: As the effects of the FQPA move forward, the IR-4 project provides data to EPA that will help maintain existing pesticide registrations as well as speed the registration of new, low-risk chemicals and pesticides.

The emphasis of IR-4 on high-priority registrations will help maintain the availability of pest control products for minor crops.

C. Source of Funding: see table for Goal 4.

D. Scope of Impact: national, EPA, MSUE, MDA, IR-4 participating states

7. Persistence of Heterodera glycines and other regionally important nematodes

A. Brief Description: Nematodes cause significant damage to Michigan crops. A research site for evaluation of 13 orchard soil nutrients and ground cover systems was developed in an established commercial cherry orchard to monitor fruit yield, tree growth, groundwater quality, ground cover establishment dynamics, nematode community structure, C-N mineralization and arthropods. Researchers found that densities of nematodes were generally higher in the conventional and synthetic input systems than in those using biological and organic input management. This confirms the hypothesis that agricultural management systems affect soil biology in ways that can be both detected and predicted through the use of nematode community structure analysis.

B. Accomplishment Statement: These results have been widely used throughout Michigan in educational programs on soil quality. Grower response has been excellent. One farmer said he used to spend most of his time managing his crops, but now he spends most of his time managing the quality of his soil.

C. Source of Funding: see table for Goal 4.

D. Scope of Impact: OH, IN, IL, PA, MSUE, AR, KS, MN, MO, NE, ND, SD, WI, MI

8. Creating a healthy Christmas tree population.

A. Brief Description: Michigan Christmas tree growers spend more than $2 million each year to protect the state’s $70 million Christmas tree industry from insect pests and diseases. MSU researchers seek alternatives to the

traditional practice of spraying broad-spectrum pesticides, the use of which was restricted by the FQPA.

B. Accomplishment Statement: Personnel assisted 300 Michigan growers in reducing the number of Christmas trees infested by pine tortoise scale (PTS) by achieving better spray coverage while reducing the number of sprays per season and total chemicals used. This allowed growers to harvest a high percentage of trees previously infested with PTS and added thousands of dollars to Michigan's economy.

C. Source of Funding: see table for Goal 4

D. Scope of Impact: WI, NY, PA, MSUE, NC, MI

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

Summary

Rural families and communities and economic development have always been part of the MAES mission. Critical issues such as quality child care, safe housing, good schools and nutritious food challenge all Michigan citizens. Community organizations and policymakers need information on best practices for making and evaluating program decisions, as well as training to allow them to be the most effective leaders possible.

Development is linked to economic growth and prosperity, something to which everyone in Michigan aspires. At the same time, everyone also wants a clean, healthy environment, with plentiful food and water for all creatures and natural areas for wildlife and vegetation, room to get away, green areas for children to play in and enough room for everyone to live comfortably.

Allocated Resources

Goal 5: Enhanced Economic Opportunity and Quality of Life for Americans

	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006
Hatch Funds						
Hatch Regular	199,755	205,954	213,260	220,420	227,437	234,313
Multi-State Funds	40,033	40,033	40,033	40,033	40,033	40,033
Other CSREES Funds*	509,357	509,357	509,357	509,357	509,357	509,357
Other Federal Funds*	355,308	355,308	355,308	355,308	355,308	355,308
Total Federal Funds (est.)	1,104,454	1,110,652	1,117,958	1,125,118	1,132,135	1,139,012
State Match for Hatch Funds	239,788	245,987	253,293	260,453	267,470	274,346
Remaining State Appropriations	1,396,468	1,439,357	1,482,611	1,527,528	1,574,151	1,622,523
Self Generated Funds*	0	0	0	0	0	0
Industry Generated Funds*	53,892	53,892	53,892	53,892	53,892	53,892
Other Non-Federal Funds*	300,034	300,034	300,034	300,034	300,034	300,034
Total State Funds (est.)	1,990,182	2,039,270	2,089,830	2,141,907	2,195,547	2,250,795
Total Estimated Funds	3,094,636	3,149,922	3,207,789	3,267,026	3,327,682	3,389,807
Scientist Years	10.6	10.6	10.6	10.6	10.6	10.6

*Values extracted from Fiscal Year 2001 Funds and Manpower Report

1. Youth Conversations.

A. Brief Description: MSU listened to Michigan youth and adults by co-sponsoring the Michigan Conversation on Youth Development, through a targeted FACT grant. The conversation is part of the National Conversation on Youth Development in the 21st Century sponsored by Congress and hosted by land-grant universities across the country with

matching support from the National 4-H Council as 4-H's 100-year birthday gift to the nation.

B. Accomplishment Statement: Nine regional conversations involving 444 participants and a state conversation with 75 individuals, took place. For youth, the top three emergent issues are negative peer pressure, substance abuse and education. Adult issues were quality of family life, need for positive role models and mentors, and education. These issues, as well as others offered by other states, were brought to the National Conversation on Youth Development in the 21st Century at the end of February 2002. At this convention, a national youth development agenda was built, outlining strategies to address specific needs of young people in the states and their communities. These strategies will help guide the work to be done in bringing the national positive youth development agenda to fruition.

C. Source of Funding: see table for Goal 5.

D. Scope of Impact: MI 4-H Foundation, MSUE, FACT, Michigan Community Service Commission, Jack & Jill of America, Governor's office, CHE, YMCA of Lansing, Mich. Parks and Recreation Assoc., United Way, Kiwanis International, MI Network for Youth and Family Services, Girl Scouts, Boy Scouts, Big Brothers, Big Sisters.

2. Osteopathic mini-medical school (Osteo-CHAMPS).

A Brief Description: This program opens doors to higher education by teaming up the Osteopathic Mini-Medical School (Osteo-CHAMPS) with Crockett Technical High School, Martin Luther King High School, Muskegon Public Schools, Muskegon Osteopathic Hospital Foundation and St. John Hospital System to introduce concepts of osteopathic medicine to high school students. The program stimulates interest in the profession, consequently increasing the pool of underrepresented minority applicants for MSU's College of Osteopathic Medicine (COM).

B. Accomplishment Statement: Twenty-seven high school Osteo-CHAMPS participants were part of a two-week summer residential session. The students from both Detroit and Muskegon took part in academic enrichment programs, developed mentoring relationships with MSU COM students and worked on research project activities with university faculty members.

In December 2001, Osteo-CHAMPS hosted a two-day admissions seminar attended by 25 students and parents. Participants interacted with a panel of health professionals and a representative from MSU undergraduate admissions. Follow-up with participants in both programs is maintained to

determine their continued interest in health careers, their academic progression and continued education-acceptance into college/community colleges, in addition to similar evaluative measures.

C. Source of Funding: see table for Goal 5.

D. Scope of Impact: Crockett Technical High School, Martin Luther King High School, Muskegon Public Schools, Muskegon Osteopathic Hospital Foundation, St. John Hospital System, MSU College of Osteopathic Medicine, MSUE, FACT

3. The Floriculture College of Knowledge Greenhouse Grower Career Development Certificate Program

A. Brief Description: This is the only bilingual certification program of its kind in the United States. It features a block of 12 courses designed to fill a labor void in Michigan's $350 million greenhouse industry. The program reinforces principles and practices that participants previously acquired and exposes them to new issues and ideas. Greenhouse growers say that this education has laborers to assume higher paying supervisory positions.

B. Accomplishment Statement: Twenty five students completed the Spanish-speaking session. This training helped several advance to higher paying positions as assistant growers. This program serves as a prototype for delivering education and training in a foreign language to members of a non-traditional audience on their own terms. Spin-off sessions are occurring because of this initial program.

C. Source of Funding: see table for Goal 5.

D. Scope of Impact: MI, MSUE, Mexico, floriculture industry with national implications.

4. Rural Welfare Reform

A. Brief Description: What is life like for poor families in rural areas since the passage of welfare reform in 1996? This question prompted researchers from 15 states to join together to investigate the little-known lives of 422 low-income families living in rural areas. The intent of the research is to provide current information to citizens, public policy-makers and program directors as a basis for decision-making about the well-being of these families.

B. Accomplishment Statement: One-year results show that more than half of mothers interviewed were food insecure as measured by the USDA food security instrument: 34 percent were food insecure without hunger and an additional 17 percent were food insecure with hunger, compared with about 11 percent in the national population. Participation in a food assistance program in 2000 did not ensure food security; rather the majority were food insecure: 72 percent of Food Stamp program participants and 69 percent of both WIC program school lunch program participants.

The project also showed food insecurity to be associated with a lower level of life skills. Seventy percent of those who don't know how to stretch their groceries to the end of month are food insecure, compared with 48 percent of those who do.

Also found was a relationship between health status and food insecurity. Of those families who experienced an illness or injury in the past year, 78 percent are food insecure vs. versus 65 percent of those who did not.

C. Source of Funding: see table for Goal 5.

D. Scope of Impact: CHE, MSUE, CA, CO, ID, IN, KY, LA, MA, MN, MO, NE, NH, OH, OR, UT, WY, MI

5. Bovine TB: The Perspective of Farm Families

A. Brief Description: Because of the threat of a major outbreak of bovine TB in Michigan, the governor issued a directive to the state departments of Agriculture, Community Health and Natural Resources to develop a strategy to eradicate bovine TB in the state. This research focused on the impact on farm families when TB-infected cattle were found on their farms. How had their quality of life changed? What/who were their sources of support and strength? The stress caused by having bovine TB on their farms was significant, and they felt the state governmental agencies were a negative force, with lack of credibility, communication and information. The state officials were felt to be deceptive. In many aspects keyed in this research, farm families' satisfaction with their lives was lower than before bovine TB.

B. Accomplishment Statement: This study laid the foundation for developing methods of educating and informing farm families about bovine TB. These methods would also be useful for use in other types of disease outbreaks or crises.

C. Source of Funding: see table for Goal 5.

D. Scope of Impact: MI, MDA, MDNR, MDCH, MSUE, CHE

Stakeholder Input Process

As indicated in the program of work for 1999-2004, the MAES has established and implemented a process to obtain input on the use of formula funds from people who benefit from agricultural research. It has a long history of working with a varied clientele.

MAES administrators meet regularly with agricultural commodity groups to assess their research needs and discuss their research agendas as it attempts to address short-, medium- and long-term issues within their areas of interest. The MAES is also in close communication with the state's departments of Agriculture, Natural Resources and Community Health. These relationships lead to the development of the MAES research agenda and programs that best serve the state. Its connections with MSUE help put research results into practice. The goal is to provide a seamless system between MAES, MSUE and stakeholders to provide the best service possible. Involvement of stakeholders is useful in reaffirming or refocusing priorities and in identifying emerging issues.

Stakeholders are also involved in the following ways:

- Serving on faculty search committees
- Serving on CSREES departmental review committees
- Serving on numerous departmental advisory boards
- Serving on grant proposal review committees – Project GREEEN and Animal Industry Initiative

MAES and MSUE developed the Michigan State University Extension and Experiment Station Council, which meets biannually. Council members learn about ongoing programs, participate in leadership development activities and advise directors on issues of concern. Members are selected based on their prior involvement and interaction with either MAES or MSUE. In addition, the MAES has sought representatives from non-traditional arenas. Such individuals typically represent a segment of the citizenry that we serve but for which there is no common representative organization.

Families and Children Together Coalition (FACT), an initiative funded in part by the MAES, has one-third of its advisory board coming from the community. These boards determine the areas of distinction for funding projects. FACT also has a competitive grant program that requires a community partner with a meaningful role in research and extension work, making it a true engagement model. FACT also holds forums at MSU for community stakeholders to explore potential connections with faculty and extension specialists.

MAES is actively involved in CARET and is a national leadership participant in program development for research and extension. It continues to involve stakeholders actively as this is embedded in its operational philosophy.

Posting of commodity group research/extension priorities on the Web through Project GREEEN. Three million dollars in projects are tied directly to these priorities.

Program Review Process

There has been no change in the program review process since we submitted the 1999–2004 POW.

Evaluating the Success of Multi and Joint Activities

Following is one of many successful multi and joint activities:

1. Project GREEEN is a cooperative effort among plant-based commodities and businesses and the Michigan Agricultural Experiment Station, Michigan State University Extension and the Michigan Department of Agriculture to advance Michigan's economy through its plant-based agriculture. Its mission is to develop research and educational programs, ensure and improve food safety, and protect and preserve the quality of the environment in response to industry needs.

   Project GREEEN is helping growers change the way they are managing their businesses, with an emphasis on integrated crop management, education, and safety. A rapid response to grower needs is a major priority. Results from many research, education and extension projects funded by Project GREEEN have been implemented in the past two years, and the number continues to grow.

   Posting of commodity group research/extension priorities on the Web through Project GREEEN. Three million dollars in projects are tied directly to these priorities.

2. In addition to research dollars for key plant agriculture projects, Project GREEEN infrastructure funds support a variety of programs and services benefiting the state's plant agriculture industry:

   Diagnostic Services is a multi-disciplinary plant health and pest diagnostic facility. Samples can be analyzed for the presence of insect pests, pathogens or nematodes. The lab also performs weed identification and deals with herbicide-related issues. Diagnostic services diagnosed 5,963 samples in 2000. Of these, about 2,500 were plant disease samples and 2,500 were nematodes samples; the rest were insects and weeds. A new species of weed not previously known to exist in Michigan, tall water hemp, was identified. In 2001, the clinic had received about 5,500 samples as of October 1.

   Pesticide Analytical Laboratory conducted 1,200 pesticide analyses on food products in 2001. This laboratory works with the EPA, the Michigan Department of Agriculture and Michigan State University faculty members to develop pest control strategies that ensure our commitment to a safe food supply.

   MSU Agricultural Weather Office provides detailed weather data for input into integrated pest management (IPM) and other weather-related decision-making models via the Internet 24 hours a day, seven days a week. The MAES, MSUE, MSU Department of Geography and the Michigan Department of Agriculture/Climatology Division jointly sponsor this office. The office and the National Weather Service provide some of the information found at *www.agweather.geo.msu.edu.*

The Michigan Department of Agriculture has two positions funded partially by Project GREEEN – a plant specialist in phytosanitation certification and a pesticide registration coordinator.

More information on Project GREEEN can be found on its Web site: *www.greeen.msu.edu.*

Integrated Research and Extension Activities

Michigan agriculture provides more than food, feed and fiber. It provides livelihoods for farmers and communities, habitats for organisms ranging from microbes to large animals, and tremendous ecological services, such as water filtration, for the surrounding environment.

The C.S. Mott Foundation Chair in Sustainable Agriculture was established to help create ways for producers to shift their traditional production practices toward those that were more sustainable. Dr. Richard Harwood holds the chair position, and for more than 10 years has worked to build a collaboration of researchers, extension and producers focused on production ecology.

“Sustainable agriculture is an agriculture that can evolve over time to have greater productivity and greater usefulness to humans in terms of food production, landscape services and environmental stability,” said Harwood. “In this way, the economics, productivity and environmental health of the land and the surrounding community continually evolve together. As Michigan’s landscape changes, agriculture has to evolve to provide services that maximize the use of biological processes occurring on farmland.”

Sustainability can apply to all farm operations – conventional, low-input or organic – as long as the systems can remain profitable over time. Starting with the soil, MAES researchers have shown that extended crop rotations can improve overall soil quality. Their work at the Living Field Lab (LFL) at the W.K. Kellogg Biological Station has focused on a four-year rotation of corn, corn, soybeans and wheat. This rotation has been found to stimulate biotic activity in the soil and enhance nutrient flow into the soil. One producer has worked with rotation experiments on his farm for 11 years and has a noted better soil health and fewer problems with weed control.

Cover crops are another important part of sustainability. MAES researchers found wheat/cover crop additions to a corn rotation can increase corn yields by 15 to 18 percent. Alfalfa can convert atmospheric nitrogen rates to between 50 to 150 pounds of soil nitrogen per acre per year, and white clover can add between 60 to 100 pounds per acre per year as a cover crop. Cover crops suppress weed growth and increase insect diversity by providing refuge. They also help prevent environmental contamination by agricultural chemicals and decrease synthetic fertilizer use.

In the insect realm, certain beneficial nematode populations can tell the story of how healthy a soil is. MAES nematologist George Bird says managing these nematode populations can improve soil health. “All you have to do is read the worms, and you can find out what state the ecosystem is in,” he said.

Where do all the weed seeds go? Considering how prolific weeds are, why isn’t the entire world covered in weeds? MAES weed scientists and entomologists have found that seed predators, such as field crickets, carabid beetles and ants feast on weed seeds, and

encouraging these beneficial insects by creating refuge areas can be part of a sustainable agriculture system.

Sustainable agriculture also touches horticultural systems. Considering the complexity of the trees, the number of insects that live among them and the fact that production systems for them is a science in and of itself, successfully growing apples is tough. Growing them organically just adds to the challenge. But MAES researchers, MSUE agents, and conventional and organic apple producers see the need for more organic fruit production, and have created the first organic apple plot at MSU at the Clarksville Horticultural Experiment Station. This integrated project joins a diverse group of researchers, producers and cooperators who have unique skills to offer and are extremely committed to make the project work.

Grazing animals is another sustainable agricultural system that MAES researchers and MSUE agents are studying. In managed intensive rotational grazing (MIRG) systems, livestock producers are rotating their animals through grazing areas and seeing healthy animals, fewer problems with soil erosion and nutrient loss, and more economic and production efficiency than many livestock confinement operations.

“The important advantage for grazing is that it provides a sustainable alternative farming system that will keep more producers on the land,” said Ben Bartlett, MSUE agent.

MAES scientists believe the best way to achieve sustainable agriculture in Michigan is through integrated, multidisciplinary research. Their work unites people across university departments and farms throughout the state.

Reference:
FUTURES, Vol. 18 No. 3/Vol. 19 Nos. 1, 2, 3
(http://www.maes.msu.edu/Futures/fall_winter2001.pdf)