

Michigan Agricultural Experiment Station Plan of Work 1999-20004

Introduction

Michigan State University, established in 1855, is the country's premier land-grant institution. It is home to the Michigan Agricultural Experiment Station, established in 1888 after the passage of the Hatch Act in 1887.

The mission of the Michigan Agricultural Experiment Station (MAES) is to generate knowledge through strategic research to enhance agriculture, natural resources, families and communities in Michigan. The MAES encompasses the work of more than 300 scientists in five colleges at Michigan State. The MAES system also includes 16 field research stations located at various sites around the state. Each field research station focuses on the particular needs of the area in which it is located — horticultural crops on the west side of the state, forestry management and products in the Upper Peninsula, and sugar beets and dry beans in the Thumb are just three examples.

To fulfill its mission, the MAES needs to have a balance between disciplinary/basic research programs and applied research programs. To keep up with the changing needs of Michigan residents, the MAES has a continuing prioritization process. MAES priorities and projects are periodically examined and updated as the needs of Michigan change. Specific examples of MAES programs and projects that relate to federal goals are listed under each goal.

This five-year plan of work outlines the goals of the Michigan Agricultural Experiment Station at Michigan State University. Though many goals are long-term, we anticipate that these programs will have an immediate impact on relevant stakeholders.

Stakeholder Input

The MAES has established and implemented a process to obtain input on the use of formula funds from people who use agricultural research. At least once a year, MAES administrators meet with representatives of each commodity or interest group in Michigan to review the work that has been done over the past year and to discuss the continued and emerging research needs of each group. Key MAES researchers, encouraged by MAES administrators, also meet with industry representatives to determine groups' individual needs. MAES administrators also meet throughout the year with representatives of Michigan Farm Bureau, the Michigan departments of Agriculture, Natural Resources and Environmental Quality, and other state/agency groups to discuss the agricultural and natural resources issues facing the state's citizens. Educational field days at the 16 MAES field research stations located around the state provide another opportunity for producers, consumers, industry representatives and other concerned citizens to discuss issues with MAES administrators and researchers.

Many academic departments affiliated with the MAES appoint private citizens who benefit from MAES research to serve on faculty position selection committees. This is done to address the needs and interests of people who are most likely to be affected by the research program of the person hired for the position.

The MAES has established a series of coalitions to address a range of issues important to Michigan: children, youth, families and communities; plant sciences; natural resources; etc. People who are considered leaders in each of the areas serve on the respective coalition and have a voice in directing the coalition's actions. This includes setting priorities for research and extension activities in that area, funding, and input into the direction of both the MAES and MSU Extension.

The MAES, in conjunction with MSU Extension, has also established a statewide advisory council to provide insight, information, direction and assistance in setting priorities. The council meets quarterly.

The MAES is also using the results of a survey done by the MSU Institute for Public Policy and Social Research to tailor information dissemination. A random sample of Michigan adults were asked how they preferred to receive research information, as well as which issues in children, youth, families and communities were most important to them.

The MAES is constantly trying to encourage stakeholders to provide more input and to develop a sense of ownership about MAES research. Every effort is made to receive input from and create programs to address the needs of underserved populations, including Hispanics and the urban poor.

Merit and Peer Review

All MAES projects funded by federal formula funds are peer reviewed before being funded. Each project undergoes at least two peer reviews by two independent faculty member reviewers, as well as review by the department chairperson and MAES administrators.

Competitive grant programs use review panels for all awards. These review panels include commodity group representatives and other external stakeholders.

Goal 1: An Agricultural Production System That Is Highly Competitive In The Global Economy

Statement of Issue:

Agriculture adds nearly \$40 billion to Michigan's economy when all aspects of production, processing and retail operations are considered. Food/agriculture is the state's second most important industry in economic terms, and the state's most stable, employing more than 500,000 people every year.

Agriculture in the state is impressively diverse — Michigan ranks third behind California and Florida in number of crops grown. Surrounded by the Great Lakes, the state has the ideal climate and soil conditions for floriculture, nursery and fruit crops in the western part of the state. The Thumb provides model conditions for dry beans and sugar beets, and southeastern Michigan boasts large numbers of turf and nursery operations. The Michigan Department of Agriculture reports that Michigan ranks in the top five producing states for 35 crops and 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.

Animal agriculture accounts for half of Michigan's agricultural income and provides more than 56,000 jobs. It includes dairy, hogs, cattle, sheep, eggs, horse racing, pleasure and sport riding, turkey operations, dairy and meat processing plants, and grain and forage crops.

Every county in Michigan benefits from agriculture, and scientists in the Michigan Agricultural Experiment Station, with input from the state's commodity groups, are working on a number of projects to ensure the continued competitiveness and robustness of Michigan agriculture in the next five years.

The MAES has three main thrusts that fall under this goal: value-added products, plant production agriculture and animal production systems. The MAES has long-term commitments to these programs but wants quick results from specific projects that will lead to other innovative work.

Because the Evaluation Framework and Output Indicators remain constant for each program area under Goal 1, they have been placed before the program areas. Because the Allocated Resources pertain to the entire goal, they have been placed before the program areas as well.

Allocated Resources

	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Hatch Funds						
Hatch Regular	2,694,810	2,640,914	2,588,095	2,536,334	2,485,607	2,435,895
Multi-State Funds	600,506	600,506	600,506	600,506	600,506	600,506
Other CSREES Funds*	4,393,258	4,393,258	4,393,258	4,393,258	4,393,258	4,393,258
Other Federal Funds*	6,351,427	6,351,427	6,351,427	6,351,427	6,351,427	6,351,427
Total Federal Funds (est.)	14,040,000	13,986,104	13,933,286	13,881,524	13,830,797	13,781,085
State Match for Hatch Funds	3,295,316	3,241,420	3,188,602	3,136,840	3,086,113	3,036,401
Remaining State Appropriations	17,125,299	17,791,814	18,475,629	19,177,318	19,897,469	20,636,689
Self Generated Funds*	1,944,346	1,944,346	1,944,346	1,944,346	1,944,346	1,944,346
Industry Generated Funds*	3,994,474	3,994,474	3,994,474	3,994,474	3,994,474	3,994,474
Other Non-Federal Funds*	756,217	756,217	756,217	756,217	756,217	756,217
Total State Funds (est.)	27,115,652	27,728,270	28,359,267	29,009,194	29,678,619	30,368,126
Total Estimated Funds	41,155,652	41,714,374	42,292,553	42,890,718	43,509,416	44,149,212
Scientist Years	90.4	90.4	91.4	91.4	91.4	91.4

*Value extracted from the Fiscal Year 1998 Funds and Manpower Report.

Evaluation Framework:

All MAES faculty members are required to have a five-year umbrella project. This is evaluated by two independent faculty member reviewers, as well as reviewed by the department chairperson and MAES administrators. Other evaluation tools used will include evidence of scholarly activities, including refereed journal articles; publication of Extension bulletins; the annual departmental performance reviews; and feedback from annual meetings with commodity and industry groups on the satisfactory progress of projects. For some research -- plant breeding for example -- it is more valuable to evaluate the work as it progresses rather than wait until the project is completed. The MAES will use the evaluation tools previously listed to evaluate on-going as well as completed projects.

Output Indicators:

MAES research program output will be assessed by reviewing the number of publications created from the research, the amount of external funding received, and the number of proposals submitted by the researcher.

Value-added Products

Key Program Components:

* Determining the genetic structure of oilseed crops to manipulate them to produce industrially valuable fatty acids.

* Purifying, characterizing the chemical composition and synthesizing natural products from plants and microbes. These compounds are being tested for use as anticancer, antioxidant, anti-inflammatory, antifungal, antibacterial, nematocidal, insecticidal and herbicidal agents. Also being studied are anti-inflammatory and antioxidant compounds from tart cherries and their effect on the quality of meat products and heterocyclic aromatic amine formation (HAA) when added into meat.

* Developing new uses for agricultural crops, including creating a process to make brandy from Michigan fruits (cherries, pears, peaches, apples and plums) and greater utilization of corn biomass.

* Initiating new-wave cooperatives based on the needs of Michigan's commodity groups and producers.

Performance Goals:

Short-term Goals

* To open a \$1.5 million, 5,000-square-foot oilseed processing plant to produce engine oil from canola and soybeans. Growers participating in the venture will receive 50 cents per bushel above commercial market prices for canola seeds and soybeans.

(Joint program with MSU Extension, the College of Agriculture and Natural Resources, and a growers cooperative.)

Intermediate-term Goals

* To create a Natural Products Center at Michigan State University. This will allow researchers working in both agricultural and biomedical research to work more efficiently and collaboratively.

(Multidisciplinary program; joint with the Office of the Vice President for Research and the College of Agriculture and Natural Resources.)

* To open an alfalfa dehydration facility in western Tuscola County. The facility would operate 29 weeks per year and process a variety of alfalfa cube products. Besides providing income from the products made from it, alfalfa also improves soil health for sugar beet growers who incorporate it into their rotations.

(Joint program with MSU Extension, the Sugar Beet Advancement Committee, and the College of Agriculture and Natural Resources.)

* To expand the fruit fermentation research program to develop the technology to produce alcoholic fruit beverages, including liqueurs and ports.

(Multidisciplinary program; joint with the Cherry Marketing Institute, the Office of the Vice President for Research, the College of Agriculture and Natural Resources, the Michigan Department of Agriculture, and Michigan Farm Bureau.)

* To create a number of new sodium-free products, including soups and snacks, using the technology that created HälsoSalt. The technique ferments cornstarch to produce lysine, a salty amino acid. MAES scientists then found a way to turn powdered lysine into a crystal, so it looks and acts like salt -- it sprinkles, it dissolves and it cooks. The crystallized lysine, which masks the bitter taste of potassium, is mixed with potassium chloride (a natural salt that is the base for many salt substitutes) and succinic acid (a naturally occurring acid found in many fruits) to make HälsoSalt, which has no bitter aftertaste.

(Multidisciplinary program; joint with the Michigan Corn Marketing Committee, the Office of the Vice President for Research, and the College of Agriculture and Natural Resources.)

Long-term Goals

* Through the Crop and Food Bioprocessing Center, scientists are working to create chemicals for food products, cleaning products, industrial solvents and polymers from the fermentation of plant biomass, primarily from Michigan agricultural crops. Biobased industrial products will be a major U.S. economic growth area in the next century as fossil-based industrial products, such as synthetic chemicals and liquid fuels, in the 20th century. Biobased industrial products will improve economic security through use of domestic rather than imported resources, optimal use of currently unused or underused land, and geographically widespread production and manufacture across the United States.

(Multidisciplinary program; joint with the Michigan Corn Marketing Committee, the Office of the Vice President for Research, the Michigan Soybean Promotion Committee, and the College of Agriculture and Natural Resources.)

Internal and External Linkages:

The MAES will work with:

* MSU Extension to open the oilseed processing plant and the alfalfa dehydration facility.

* A growers cooperative to open the oilseed processing plant.

* The MSU Office of the Vice President for Research and Graduate Studies to create a Natural Products Center on campus, to expand the fruit fermentation program, to create new sodium-free products and to create new biobased chemicals from Michigan agricultural products.

- * The Sugar Beet Advancement Committee to open the alfalfa dehydration facility.
- * The Cherry Marketing Institute to expand the fruit fermentation program.
- * The Michigan Corn Marketing Committee to create new sodium-free products and to create new biobased chemicals from Michigan agricultural products.
- * The Michigan Soybean Promotion Committee to create new biobased chemicals from Michigan agricultural products.
- * The College of Agriculture and Natural Resources to open the oilseed processing plant and the alfalfa dehydration facility, to create new sodium-free products, to expand the fruit fermentation program and to create new biobased chemicals from Michigan agricultural products.
- * The Michigan Department of Agriculture and Michigan Farm Bureau to create a value-added center for Michigan farmers.

Target Audiences:

MAES programs in value-added products are intended to assist agricultural producers and processors, consumers and retailers in Michigan. These programs will also identify and assist food entrepreneurs to develop businesses and enhance the state's economy.

Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

- * Is an oilseed processing plant operating?
- * Is there a Natural Products Center on the MSU campus?
- * Is an alfalfa dehydration facility operating?
- * Are fruit liqueurs and fruit ports being produced?
- * Are new sodium-free products being produced?
- * Are food products, cleaning products, industrial solvents and polymers being produced from the fermentation of corn?

Plant Production Agriculture

Key Program Components:

* Enhancing the economic viability of producers and processors of Michigan's more than 65 specialty/minor crops.

* Helping Michigan growers comply with the new pesticide use and residue regulations mandated by the Food Quality Protection Act by developing new methods of pest and disease control, maintaining the Pesticides-At-Risk (PAR) database and registering pesticides for use on minor/specialty crops.

* Understanding the structure and function of plant genomics, including molecular mapping; specially designed plants that produce desirable compounds such as biodegradable plastic, phytoremediation; natural ecosystems; principles of plant growth and development; and plant pest control.

* Meeting the needs of Michigan's floriculture and turf industries.

Performance Goals:

Short-term Goals

* To create new diagnostic lab services for Michigan residents. The facility, Diagnostic Services, will include diagnoses of weed, plant disease, insect and nematode problems. It also will assist in the identification of fungi and plants. It will combine the work of the former Plant and Pest Diagnostic Clinic, the Arthropod Diagnostic Clinic and the Nematode Diagnostic Service Laboratory.

(Joint program with MSU Extension, and the colleges of Agriculture and Natural Resources and Natural Science; multidisciplinary program.)

* To strengthen applied research in the plant sciences, crop integrators in nursery, fruit, vegetables and field crops will be hired. They will be located on campus and will offer individual industries another direct link to MSU expertise.

(Joint program with MSU Extension, the College of Agriculture and Natural Resources and Michigan plant commodity groups; multidisciplinary program.)

* To strengthen the plant sciences, a scientist who specializes in phytoremediation (using plants to reduce and contain environmental contaminants in the environment) will be hired.

(Multidisciplinary program; joint program with the Office of the Provost, and the College of Agriculture and Natural Resources.)

Intermediate-term Goals

* To strengthen plant research programs, three scientists in plant genomics will be hired: one in applied structural genetics, one in functional genetics and one in bioinformatics.

(Multidisciplinary program; joint program with the College of Agriculture and Natural Resources, and the Office of the Provost.)

* Two scientists who specialize in genetically engineered plants will be hired to design new plant products, such as pharmaceuticals, nutraceuticals and other valuable materials.

(Multidisciplinary program.)

* To develop new growing strategies for flowering plant growers. So far, MAES scientists have chosen 100 perennial plants and determined the conditions that cause each to flower — growers can follow a prescribed plan and can make the plants flower whenever they'd like, offering growers more opportunities to sell plants.

(Joint program with MSU Extension and the College of Agriculture and Natural Resources.)

Long-term Goals

* To maintain and update the Pesticides-At-Risk (PAR) database. This database examines critical pesticides used for each crop grown in Michigan and ranks them according to the impact of their loss on the state's agricultural economy.

(Joint program with MSU Extension and the colleges of Natural Science and Agriculture and Natural Resources; multidisciplinary program.)

* To establish a centralized recruiting and application process for the plant sciences so MSU can continue to attract the very best plant science graduate students.

(Multidisciplinary program.)

* To register pesticides for use on minor/specialty crops. MSU is home to one of four multistate laboratories through National Research Support Project 4 that helps specialty crop producers maintain access to effective pesticides.

(Multistate program.)

* To develop new plant varieties that are resistant to diseases and insects and have the necessary agronomic traits to benefit Michigan producers.

(Multidisciplinary program; joint with Michigan plant commodity groups and the College of Agriculture and Natural Resources.)

* To maintain the national reputation that MSU has in plant science research.

Internal and External Linkages:

The MAES is working with:

- * MSU Extension on creating new diagnostic lab services, hiring crop integrators, developing new growing strategies for flowering plant growers and maintaining the Pesticides-At-Risk database.

- * The College of Natural Science to create new diagnostic lab services and maintain the Pesticides-At-Risk database.

- * Michigan plant commodity groups to hire crop integrators and develop new plant varieties.

- * The College of Agriculture and Natural Resources to create new diagnostic lab services, hiring crop integrators, develop new growing strategies for flowering plant growers, maintain the Pesticides-At-Risk database, and hire a phytoremediation specialist and three plant genomics scientists

Target Audiences:

MAES programs in plant production agriculture are intended to assist agricultural producers and processors, consumers and retailers in Michigan.

Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

- * Do Michigan residents have access to new diagnostic laboratory services?
- * Were integrated crop management coordinators hired for fruit, vegetable and ornamental crops?
- * Were crop integrators hired for nursery, fruit and field crops?
- * Was a phytoremediation scientist hired?
- * Were three plant genomics scientists hired (one in applied structural genetics, one in functional genetics and one in bioinformatics)?
- * Were two scientists who specialize in genetically engineering plants hired?
- * Is the Pesticides-At-Risk database being updated and maintained?

* Has a centralized recruiting and application process for the plant sciences been established?

* Are pesticides being registered for use on minor/specialty crops?

* Are new growing strategies being developed for flowering plant growers?

* Are new plant varieties being developed?

Animal Production Systems

Key Program Components:

* Better understanding of animal diseases, animal nutrition and animal health.

* Manure management.

* Animal genomics, including work to identify genes that control economically important traits such as reproduction, well-being, growth, milk production, and disease resistance; development of transgenic mouse models of chronic human disease; development of transgenic livestock models for human disease; and biopharmaceutical production.

Performance Goals:

Intermediate-term Goals

* To combat bovine tuberculosis infection in wild white-tailed deer in Michigan and return the state to TB-free status. This includes:

1. Developing a highly sensitive, specific and rapid test for *Mycobacterium bovis*, the bacterium that causes bovine tuberculosis in deer.

2. Developing a way to genetically characterize various strains of bovine tuberculosis.

3. Determining patterns of antimicrobial resistance among *Mycobacterium bovis* strains.

4. Determining the pathogenesis of *Mycobacterium bovis* in deer and other animals.

5. Determining the epidemiology of bovine tuberculosis in Michigan.

6. Evaluating the effectiveness of bovine tuberculosis surveillance and control program in Michigan.

7. Determining the economic and social impact of bovine tuberculosis on Michigan.

(Joint program with MSU Extension, the College of Agriculture and Natural Resources, the Michigan Department of Agriculture, the Michigan Department of Natural Resources and the USDA; multidisciplinary program.)

- * To study the epidemiology of Johne's Disease.

(Joint with the colleges of Veterinary Medicine and Agriculture and Natural Resources.)

- * To develop enterprise-level systems models in irrigation and waste management for dairy, swine and poultry operations that evaluate ration tradeoff, land availability and total production.

(Joint project with MSU Extension, the College of Agriculture and Natural Resources, the Michigan Department of Agriculture, the Michigan Department of Environmental Quality and animal commodity groups; multidisciplinary program; multistate program.)

- * To develop and refine methodology, technology and management practices to reduce odors, gases, and airborne microflora, particulate matter and other airborne emissions in animal production systems.

(Multidisciplinary program; multistate program; joint with MSU Extension and the College of Agriculture and Natural Resources.)

- * To develop and evaluate feeding systems for their potential to alter the excretion of environmentally sensitive nutrients by livestock.

(Multidisciplinary, multistate program.)

- * To create a strategic partnership to initiate a new research area in the identification of candidate genes that control traits of importance for humans and animals (e.g., genes for leanness and disease resistance). In addition, this partnership will provide information for gene mapping and a better understanding of gene regulation.

(Multidisciplinary program; joint with the Office of the Provost, the College of Agriculture and Natural Resources, and the Office of the Vice President for Research and Graduate Studies.)

- * To establish a Hannah Professorship in animal biotechnology/transgenics.

(Joint program with the Office of the Provost and the College of Agriculture and Natural Resources.)

Long-term Goals

- * To establish a transgenic animal facility at Michigan State University to facilitate research in developing transgenic mouse models of chronic human disease, basic research in cloning, and developing transgenic livestock models for human

disease and biopharmaceutical production and study of gene function.

(Multidisciplinary program; joint program with the Office of the Provost, the Office of the Vice President for Research and Graduate Studies, and the colleges of Agriculture and Natural Resources and Veterinary Medicine.)

* To provide objective criteria for the evaluation of animal welfare indicators in various species. The biology of systems for coping with the environment may be different among animal species, and scientific investigation needs to be carried out to identify useful and reliable indicators. The causes of welfare problems may be associated with long-term or short-term problems. Housing systems, management methods, operations and other procedures, accidents, neglect or deliberate cruelty which might cause poor welfare need to be investigated.

(Multidisciplinary; joint project with the Scottish Agricultural College, the College of Agriculture and Natural Resources, and the Office of the Vice President for Research and Graduate Studies.)

Internal and External Linkages:

The MAES will work with:

* MSU Extension to combat bovine tuberculosis in deer in Michigan; to develop methodology to reduce airborne emissions in animal production systems; and to develop models in irrigation and waste management for dairy, swine and poultry operations.

* The Michigan Department of Natural Resources to combat bovine tuberculosis in deer.

* The Michigan Department of Agriculture to combat bovine tuberculosis in deer.

* The Michigan Department of Environmental Quality to develop models in irrigation and waste management for dairy, swine and poultry operations.

* The Office of the Vice President for Research and Graduate Studies to identify candidate genes; establish a transgenic animal facility and provide objective criteria for evaluating animal welfare.

* The Office of the Provost to identify candidate genes, to establish a Hannah Professorship and to establish a transgenic animal facility.

* The Scottish Agricultural College to provide objective criteria for evaluating animal welfare.

* The College of Agriculture and Natural Resources to combat bovine tuberculosis in deer in Michigan; to develop methodology to reduce airborne emissions in animal production systems; to develop models in irrigation and waste management for dairy, swine and poultry operations; to identify candidate genes; to establish a transgenic animal facility; to provide objective criteria for evaluating animal welfare; to study the epidemiology of Johne's Disease; and to establish a Hannah Professorship.

* The College of Veterinary Medicine to study the epidemiology of Johne's Disease and to establish a transgenic animal facility.

Target Audiences:

MAES programs in animal production systems are intended to assist agricultural producers and processors, consumers and retailers in Michigan.

Outcome Indicators:

MAES directors, department chairpersons and commodity leaders annually will look at the objectives of each program and compare them to the results and assess the program's progress and success. At the end of five years, specific indicator questions to be asked include:

- * Was a rapid test for *Mycobacterium bovis* developed?
- * Can different strains of bovine tuberculosis be genetically characterized?
- * Have patterns of antimicrobial resistance among *Mycobacterium bovis* strains been determined?
- * Has the pathogenesis of *Mycobacterium bovis* in deer and other animals been determined?
- * Has the epidemiology of bovine tuberculosis in Michigan been determined?
- * Has the effectiveness of bovine tuberculosis surveillance and control programs in Michigan been evaluated?
- * Have the social and economic impacts of bovine tuberculosis on Michigan been determined?
- * Has the epidemiology of Johne's Disease been determined?
- * Have enterprise-level systems models in irrigation and waste management for swine, dairy and poultry operations been developed?
- * Have the methodology, technology and management practices been developed to reduce odors, gases, and airborne microflora, particulate matter and other airborne emissions in animal production systems?
- * Have new feeding systems designed to alter the excretion of environmentally sensitive nutrients by livestock been developed and evaluated?
- * Has a strategic partnership to initiate a new research area in the identification of candidate genes that control traits of importance for humans and animals been established?

* Has a Hannah Professorship in animal biotechnology/transgenics been established?

* Has a transgenic animal facility been established at Michigan State University?

* Have objective criteria for evaluating animal welfare been developed?

Goal 2: A Safe and Secure Food and Fiber System

Statement of Issue:

Food safety once again made headlines in Michigan at the end of 1998. News stories reported that the U.S. Centers for Disease Control and Prevention were blaming *Listeria*-contaminated hot dogs and lunchmeat from a processing plant in Zeeland for the deaths of 12 people and sickness of 79 others. Then the U.S. Department of Agriculture ordered Southfield-based Thorn Apple Valley, Inc., to recall 30 million pounds of hot dogs and lunchmeat. No illnesses or deaths were attributed to the products, but the plant was cited for unsanitary conditions. Then Detroit-based Hygrades, owned by Sara Lee, took 72,000 packages of hot dogs made at its Detroit plant out of stores after the Michigan Department of Agriculture found *Listeria* bacteria in sandwich spread made from the hotdogs.

Because *Listeria* is found virtually everywhere in the environment — soil, dust, water, sewage — and, unlike most bacteria, can continue to multiply in refrigerator temperatures, these outbreaks were frightening and confounding to all involved. The methods used to inspect the food supply were publicly questioned. How could this happen in what everyone agrees is the world's safest food supply?

On the surface, the issue seems relatively simple: everyone — consumers, producers and researchers — wants a safe and plentiful food supply. So if all agree, why is there so much confusion and controversy surrounding the subject?

Untangling the web of food safety issues requires one to consider all the social, cultural, economic and environmental aspects of producing food — not a small task.

The concept of risk plays an important role in understanding food safety. MSU is home to the National Food Safety and Toxicology Center (NFSTC), which recently hosted a conference on risk analysis for people working on food safety at all levels. Several MAES researchers affiliated with the NFSTC are using risk assessment as a framework to study risks associated with food. Closely related to risk assessment is the idea of risk management — figuring out ways to minimize risk at specific points in the food system. Scientists agree that this is most effective when several links of the food chain, from producer to consumer, are targeted simultaneously.

In 1996, the Food Quality Protection Act (FQPA) was passed unanimously by Congress and signed into law by President Clinton. The FQPA makes dramatic changes in the way the Environmental Protection Agency sets tolerances for pesticide residues on food crops and will likely affect the availability of pesticides for both food and non-food uses. To date, implementation of the FQPA has been slow, and many growers are fearful they may not be able to use certain pesticides that have been essential to producing high-quality crops in amounts that are profitable. Consumers are concerned that, while the implementation process inches along, they and their children are being exposed to levels of pesticides that may be unsafe.

MAES scientists are working to help growers, consumers and industry representatives sort through the legislation and the issues surrounding it.

The MAES has two main areas of emphasis that fall under goal 2: food safety, which includes pre- and postharvest research programs, research to improve the surveillance and monitoring of the food supply, research on microbial food safety and research on chemical food safety; and risk assessment and risk management.

Because the Evaluation Framework and Output Indicators remain constant for each program area under Goal 2, they have been placed before the program areas. Because the Allocated Resources pertain to the entire goal, they have been placed before the program areas as well.

Evaluation Framework:

All MAES faculty members are required to have a five-year umbrella project. This is evaluated by two independent faculty member reviewers, as well as reviewed by the department chairperson and MAES administrators. Other evaluation tools used will include evidence of scholarly activities, including refereed journal articles; publication of Extension bulletins; the annual departmental performance reviews; and feedback from annual meetings with commodity and industry groups on the satisfactory progress of projects. For some research -- plant breeding for example -- it is more valuable to evaluate the work as it progresses rather than wait until the project is completed. The MAES will use the evaluation tools previously listed to evaluate on-going as well as completed projects.

Output Indicators:

MAES research program output will be assessed by reviewing the number of publications created from the research, the amount of external funding received, and the number of proposals submitted by the researcher.

Allocated Resources:

	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Hatch Funds						
Hatch Regular	277,562	289,649	301,498	313,104	324,480	335,629
Multi-State Funds	113,233	113,233	113,233	113,233	113,233	113,233
Other CSREES Funds*	1,414,721	1,414,721	1,414,721	1,414,721	1,414,721	1,414,721
Other Federal Funds*	716,501	716,501	716,501	716,501	716,501	716,501
Total Federal Funds (est.)	2,522,018	2,534,104	2,545,953	2,557,559	2,568,935	2,580,084
State Match for Hatch Funds	390,796	402,882	414,731	426,337	437,713	448,862
Remaining State Appropriations	1,788,660	1,841,957	2,397,453	2,470,213	2,545,733	2,624,087
Self Generated Funds*	150,675	150,675	150,675	150,675	150,675	150,675
Industry Generated Funds*	506,552	506,552	506,552	506,552	506,552	506,552
Other Non-Federal Funds*	105,521	105,521	105,521	105,521	105,521	105,521
Total State Funds (est.)	2,942,204	3,007,587	3,574,933	3,659,298	3,746,195	3,835,698
Total Estimated Funds	5,464,221	5,541,692	6,120,886	6,216,857	6,315,130	6,415,782
Scientist Years	9.5	9.5	10.5	10.5	10.5	10.5

*Value extracted from the Fiscal Year 1998 Funds and Manpower Report.

Food Safety

Key Program Components:

* Enhancing the economic viability of animal production in Michigan by continuing to register beneficial treatments through the Minor Use Animal Drug Program for the North Central Region.

* Better understanding the epidemiology of *E. coli* in cattle.

* Developing new surveillance and monitoring techniques for food.

* Characterizing new organisms and strains of pathogens that cause food-borne disease.

* Identifying genetic and molecular traits that have resulted in changes in microbial pathogenicity.

* Better understanding the nature and mechanism of the action of bacterial toxins.

* Better understanding the nature and mechanism of endocrine disrupters.

* Better understanding processing-induced toxicants in food.

Performance Goals:

Short-term Goals

- * Provide a rapid response to food safety crises in Michigan.

(Joint with MSU Extension and the colleges of Agriculture and Natural Resources and Veterinary Medicine.)

Intermediate-term Goals

- * Determining how HACCP (hazard analysis critical control point) programs can be used to control outbreaks of *E. coli* 0157:H7 in cattle operations.

(Multistate, multi-institutional program.)

- * Develop a rapid test for *Campylobacter jejuni*, a bacterium that is the leading cause of intestinal infection in humans, and other pathogenic microorganisms.

(Multidisciplinary; joint with the colleges of Veterinary Medicine and Agriculture and Natural Resources.)

- * Develop a rapid, easy-to-use test to determine if meat products have been cooked at the proper temperature for a sufficient amount of time.

(Multidisciplinary.)

- * Further the understanding of the role of chemical contaminants, micronutrients and bacterial pathogens in gene expression and the etiology of adverse health effects in humans, livestock and wildlife by hiring a scientist who specializes in genomics research and gene array technology.

(Multidisciplinary program; joint with the colleges of Veterinary Medicine, Agriculture and Natural Resources, and Human Medicine.)

Long-term Goals

- * Continuation of the Minor Use Animal Drug Program for the North Central Region.

(Multistate, multi-institutional, multidisciplinary program.)

- * Studying the evolution of new food-borne pathogens by hiring a scientist who specializes in evolutionary biology. *(Note: the hiring of the evolutionary biologist is a short-term goal, but the study of the evolution of food-borne pathogens is a long-term goal.)*

(Multidisciplinary program; joint with the Office of the Provost and the College of Agriculture and Natural Resources.)