Annual Report
of
Accomplishments and Results

FY 2003

Plan of Work for Agricultural Research and Extension Formula Funds (AREERA)

Minnesota
Agricultural
Experiment
Station

UNIVERSITY OF MINNESOTA

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Executive Summary

This report of research progress for 2003 summarizes MAES research in several areas. As we did in last year's report, we include joint Extension/Research sections under key themes. This year those are: *Agricultural Competitiveness, Plant Production Efficiency, Food Safety, Human Health, and Agricultural Waste Management*. A sign of the credibility and the impact of MAES research that is documented in this report is the scope of that research—the fact that it is has been adopted by other states and in some cases has had an impact internationally. This can be seen in everything from a web-based farmer's production management tool, to Minnesota producer crop varieties requested by Argentina and New Zealand, to family research here informing adoption policies in Britain. Further information on the projects reported here can be found in *Minnesota Impacts*, (www.mnimpacts.umn.edu) a Web-based public accountability database of the Minnesota Agricultural Experiment Station.

Goal 1: **Through research and education, empower the agricultural system with knowledge that will improve competitiveness in domestic production, processing and marketing. (An agricultural system that is highly competitive in the global economy.)**

MAES funded research has contributed to advances toward achieving this broad goal in many targeted ways. It is interesting to see how much the techniques of biotechnology have been adopted and integrated into a broad spectrum of research, from control of animal diseases, to productivity of crops. Therefore, although we do discuss specific biotechnology advances under that key theme, the techniques also inform several research project discussed under other themes. There is progress reported this year under Goal 1 relating to reproductive efficiency in animals; tools to provide important marketing and production systems information to farmers; and crop pest management improvement. Progress in limiting or controlling several threats to Minnesota agriculture, such as potato leaf blight, Fusarium head blight, and soybean aphid is described. Three major animal diseases: Johne's disease in dairy cattle, avian pneumovirus, and porcine reproductive and respiratory syndrome virus (PRRSV) have been plaguing Minnesota animal producers, and significant progress has been made on these three fronts.

Total Expenditures by Source of Funding
Hatch--$376,847; MRF--$251,762; State--$1,588,982; Other Federal--$1,235,145; Other Non-Federal--$1,020,481

Total (Experiment Station only): $4,473,217
FTE's (Experiment Station only): 46.2

Goal 2: **To ensure an adequate food and fiber supply and food safety through improved science based detection, surveillance, prevention and education (A safe and secure food and fiber system.)**

Research has focused on rapid detection methods of pathogens to help the food industry. It has also found a technique to improve the quality of meats that not only destroys pathogenic microorganisms but reduces its cholesterol content. Biotechnology has been used by Minnesota food science researchers for many years, one prominent example being in their ground-breaking work on dairy starter cultures. This report discusses progress in work to produce nisin, a bacteriocin which combats the growth of spoilage microorganism in food. To combat the fear of the spread of Chronic Wasting Disease, a Veterinary Diagnostic Laboratory was constructed and is now being used to expand "Mad Cow Disease" surveillance in Minnesota.

Total Expenditures by Source of Funding
Hatch--$39,247; MRF--$1,053; State--$258,525; Other Federal--$21,472; Other Non-Federal--$64,181

Total (Experiment Station only): $384,478
FTE's (Experiment Station only): 3.5

Goal 3**: Through research and education on nutrition and development of more nutritious foods, enable people to make health-promoting choices. (A healthy, well-nourished population.)**

Progress in human health research has identified specific foods that promote health, as well as identified human behaviors and perceptions that limit healthy food choices. We report this year on the effect of different fat sources on heart disease; the cancer-prevention capacity of certain foods; on adolescents' consumption of calcium-rich foods, as well as the potential of native foods for improving the health of American Indians.

Total Expenditures by Source of Funding
Hatch--$74,020; MRF--$610; State--$316,563; Other Federal--$124,698; Other Non-Federal--$770,712

Total (Experiment Station only): $1,286,603
FTE's (Experiment Station only): 12.1

***Goal 4*: Enhance the quality of the environment through better understanding of and building on agriculture's and forestry' complex links with soil, water, air and biotic resources. (An agricultural system that protects natural resources and the environment.)**

The management of Minnesota's natural resources is a large set of issues that affect a broad range of audiences. This year's report focuses on research progress and accomplishments in some specific areas: research into fish stocking of Minnesota lakes; the impact on Minnesota's timber harvesting guidelines on forest landowners, as well as the release of a new edition of a popular software tool that is useful in both public education and resource management decision-making. The themes *Agricultural Waste Management* and *Water Quality* are closely related. But in this year's report we have used the former to focus on progress in research in odor control for livestock producers, as well as systems to help dairy producers avoid improper handling of milk house wastewater, while in *Water Quality* we discuss specific impacts of research on Minnesota's lakes and rivers.

Total Expenditures by Source of Funding
Hatch--$77,235; MRF--$32,275; McIntire-Stennis--$17,018; State--$305,081; Other Federal--$1,162,287; Other Non-Federal--$226,108

Total (Experiment Station only): $1,820,104
FTE's (Experiment Station only): 18.8

***Goal 5*: Empower people and communities, through research-based information and education, to address the economic and social challenges facing our youth, families, and communities. (Enhanced economic opportunity and quality of life for Americans.)**

This year's report focuses on two themes, both relating to improving family quality of life. *Family Vitality* describes the impact of family social science research on the understanding of family stress such as boundary ambiguity, child adoption policies, and new immigrant intergenerational challenges. *Family Resource Management* describes research that has illuminated both public policy issues as well as developed individual household financial management strategies to improve their financial health.

Total Expenditures by Source of Funding
Hatch--$13,724; State--$129,077; Other Federal--$69,198; Other Non-Federal--$97,934

Total (Experiment Station only): $309,933
FTE's (Experiment Station only): 3.6

Key Theme: Agricultural Competitiveness (JOINT)

MAES Plan of Work: GOAL 1, Programs 1, 2, 3, and 5

a. Description

The Center for Farm Financial Management at the U of M has a long history of working with farm management associations in Minnesota and other states. The center also has the most comprehensive and up-to-date set of software tools for farm management associations. One of their MAES sponsored projects is to build a national comprehensive internet-based farm financial and production management database from actual farm data, and make it readily available to all producers. They are cooperating with other farm management programs in nine states to develop this uniform farm management database.

b. Impact

As a result of this project the online FINBIN database has been expanded and refined to allow producers and agricultural professionals to search and query actual farm data from more than 3,200 farms representing more than 2.4 million acres of crop land, over 64,000 dairy cows, nearly 20,000 sows, and over 630,000 grow/finish pigs. Approximately 3,000 Minnesota farmers annually directly benefit and use the software and database associated with this project. Many other Minnesota producers benefit indirectly from this project by being able to benchmark and learn about the strengths and weaknesses of their farm business by accessing the online database.

a. Description

More than 400 dairy heifers were used in a three-year study on a commercial livestock operation in central Minnesota to compare feedlot confinement and management intensive grazing. Researchers were looking at both economics and heifer performance on a typical alfalfa/corn/soybean rotational system. Over the three year, the management intensive grazing system had lower daily costs of between $.20- to-$.60 per heifer. There were no differences in heifer average daily weight gain between the two systems.

b. Impact

The completed studies provide information towards development of economically viable systems for raising dairy heifers

a. Description

Researchers investigated the importance of an emerging hay market to the dairy industry. They assessed the costs and benefits of hay maceration, a relatively new technology that allows faster drying of hay. The benefits assessment was based on forage production modeling using University of Wisconsin software, and the U of M Machinery Economic Cost Estimates. The work showed the potential benefits of improved hay quality can be greater than the increased cost of the maceration equipment.

b. Impact

The assessment of hay production technologies and markets provides dairy producers and hay producers alternative enterprises that can enhance their farming operations.

a. Description

There are many ingredient and manufacturing conditions involved in manufacturing process and natural cheese, and therefore in an industrial setting these cheeses are produced on a very large scale. As an example, the batch size for Cheddar and Mozzarella cheese is 35,000 lbs. These constraints have limited research on natural and process cheese because the cost of conducting research using industrial scale equipment is prohibitive. Food science researchers have developed two small-scale manufacturing systems that can be used to conduct research on natural and process cheese.

b. Impact

With this small-scale system, the researchers developed a modified process cheese formulation that allowed a local manufacturer to use a new ingredient that will result in an annual savings of $250,000. They have also developed new manufacturing procedures for cottage and Mozzarella cheese that will also be valuable for the cheese industry.

a. Description

One applied economics project is helping farmers plan and adjust for the future by identifying and interpreting the impact of the complex forces affecting farming, monitoring trends in farm financial performance, and evaluating potential alternatives for farms to improve their viability. As part of this work, a new farm management textbook was published in 2003, which includes strategic management, quality management and new techniques and tools in production and operations management. A companion website has additional materials including virtual field trips (complete with video and audio) and links to other pertinent sites. Other research focuses on specific producer groups. For example, a farm and market survey for Hmong specialty crop farmers in the Twin Cities metropolitan area found that most had farm product sales between $3,000 and $9,000. An analysis of the economic impact of reducing organophosphate use in seed potato production by scouting and treating only field borders for aphids (versus the entire field) show a possible cost reduction of about $24/acre.

b. Impact

This work has specific utility to farmers, bankers, students, and policy-makers as it is useful for both management decisions and policy analysis.

a. Description

Currently 20-to-30 percent of hogs marketed are marketed under some type of contract arrangement with packers. An applied economics researchers have done a study of the economics of risk management and marketing contracts in swine.

b. Impact

With 100,000 head marketed per year and an average value per head of about $100, the potential total value of hog marketings affected is about $2 billion. However, the marginal value is probably only 1-to-2 percent of that, or about $20 million. This would be assuming every hog producer with a contract makes a decision based on the information, which is unlikely. It is probably more in the area of 2-to-5 percent of growers, for about $400,000. However, the researcher has also done specific analyses worth multi-millions in value as a result of this expertise.

a. Description

A twinning study has been performed to induce genetically unrelated twins in postpartum suckled beef cows. Six Angus cows at an MAES's north central Minnesota research center were diagnosed to be pregnant with twins (TWIN) via ultrasound after receiving one embryo, seven days following TAI. Following delivery of two live calves, these cows were matched with cows delivering single calves, and their progress compared. A major advantage of the TWIN treatment is the potential of increasing the overall calves produced with a similar number of cows. The advantage of this system is that managing cows pregnant with twins can be achieved earlier, by identifying cows destined to have twins with ultrasound. These cows can be managed separated and calving can occur with little or no extra input.

b. Impact

There are approximately 16,000 beef producers in Minnesota and a total of 400,000 cows. By inducing twins in an operation, producers could potentially increase the pounds weaned per cow by 100 pounds, which would increase income to operations by $400,000. In addition, estrous synchronization improves uniformity, genetic potential and pregnancy rates. By increasing the percentage of cattle estrous synchronized from 7 percent to 20 percent will increase income over $1 million, considering that the improvements in production for cows estrous synchronized results in a minimum of $20/cow.

a. Description

Reproductive efficiency in female turkeys is low when compared to chickens, mainly because the onset of incubation behavior causes an early termination of egg laying. Researchers have established that vasoactive intestinal peptide (VIP) contributes to this behavior in turkeys, and VIP-immunized turkeys reduce incubation behavior and lay more eggs.

b. Impact

Improvements in reproductive performance of turkeys as a result of this research are significant. It reduces the incident of incubation from 51 percent to 8 percent, and represents an increase of almost 33 eggs per hen in a 27 week reproductive season. This reduces the cost of market production, and leads to increased productivity from fewer animals.

Extension Plan of Work: GOAL 1, Agriculture, Food, and Environment Capacity Area, Soybean Production, Soybean Aphid, Alternative/Specialty Crop, and Organic, Alternative, and Specialty Production Programs

a. Description

Minnesota produces over 5% of the world's soybeans. As a result, soybeans consistently rank as one of Minnesota's top three commodities in terms of cash receipts. Soybean sales brought in nearly $1.2 billion to the state's agricultural economy in 2001. In the past two years, Minnesota farmers have planted more acres of soybeans than any other crop. To continue to be competitive in the world market, Minnesota producers need to constantly adapt to new varieties, new production and marketing techniques, and new

usages. Current challenges to Minnesota producers include iron chlorosis and the soybean aphid.

b. Impact

Educators are focusing on improving soybean producers' selection of more productive varieties, pest management—especially of the soybean aphid, soil fertility and water management, soil erosion control, and other important agronomic practices to improve the profitability and reduce the environmental impact of soybean production in Minnesota. They evaluated 29 varieties of special use soybeans in field trials during 2003. Educators estimated that producers can earn an average of $1.25 a bushel more for these varieties. At an average yield of 40 bushels/acre and 10,000 acres of special use soybeans planted in 2003, this premium added about $500,000 to these producers' cash receipts.

One educator in Southwest Minnesota reported that producers in his region have switched up to 80% of their acreage to SCN resistant soybean varieties. Another educator in the central part of the state estimated that 75% of the soybean acres in his region were sprayed for soybean aphid during 2003. Growers that did not spray for aphids lost an estimated 8.8 bushels/acre in yield. At $6/bushel, this is a loss of $52.80/acre. The regional educator in West Central Minnesota reported that there were 45,000 acres in his area sprayed at a cost of $9/acre or $405,000. Producers who sprayed increased their yield an average of 5 bushels. At $6.50 a bushel, spraying earned these producers an additional $1.5 million—an estimated net return of well over $1 million. In South Central Minnesota, almost every acre of soybeans—a total of 125,000 acres--was sprayed for aphids. The increased yield was estimated at an average of 12 bushels/acre, boosting farm income in this region by over $10 million.

c. Source of funding: Hatch and Smith-Lever

d. Scope of impact: State and Multi-State

Key Theme: Animal Health (RESEARCH)

MAES Plan of Work: Goal 1, Programs 4, 5 and 6

a. Description

In last year's Annual Report of Accomplishments and Results, we described the breakthrough work at the U of M to sequence the genome of the bacteria that cause Johne's disease, a major chronic wasting disease found in dairy cattle. This disease has cost the dairy industry more than $200 million a year. A the same time this work was focusing on biotechnology solutions to this disease problem, other work has been focusing on determining the on-farm risk factors for development of Johne's disease. Results from environmental sampling has shown that the most common contaminated areas within infected dairy farm environments are early lactation cow alleyways and manure storage areas (mainly manure lagoons.) Calving barns, sick cow pens, dry cow

pasture areas, and areas exposed to runoff from the milking parlor were also found to be contaminated.

b. Impact

These study results will have an important impact on Johne's disease control programs, by focusing management practices on areas around farms with highest prevalence of contamination. The research shows that control of Johne's disease will be accomplished by breaking the in-herd infection cycle through maintaining clean cow environments instead of primary focus on culling of test-positive cows.

a. Description

Avian pneumovirus (APV) is a respiratory disease that U of M scientists first detected in 1997. The disease has spread throughout the turkey-producing areas of Minnesota, causing roughly $15 million a year in production losses. We reported last year that researchers had successfully developed a vaccine that protects against APV, and this vaccine had been approved by the USDA for sale in the Midwest. This year we can report that researchers have succeeded in one of the long-term goals of the project—the development of the world's first and only non-virally immortalized continuously growing turkey cell line that was derived from turkey turbinate epithelial tissue.

b. Impact

Researchers have determined this new turkey-specific cell line supports the propagation of APV. Researchers consistently have been able to achieve APV titers as good as or better than the currently used standard substrate, monkey Vero cells.

a. Description

Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) is a viral infection that causes severe reproductive failures in sows and high levels of pneumonia in young pigs. Outbreaks among herds have been unpredictable and varied. One particularly problematic dimension of PRRSV is that it frequently mutates into new strains, making it even more difficult to control over the long term. Research into the mechanisms of this disease and methods for its detection, protection and elimination has studied the routes of PRRSV transmission via non-porcine vectors. It has revealed that transmission of PRRSV from pig-to-pig can take place following contract with a single house fly. Researchers determined that transport vehicles could be reliably sanitized of PRRSV by a cleaning protocol using power washing, disinfection and drying. Other research to track viral spread in the field has used spatial analysis tools to detect relationships between geographic location and presence of PRRS virus.

b. Impact

These finding will aid in the development of more effective measures for control of PRRS. Biosecurity measures for exclusion of PRRSV from production facilities can be improved with better understanding of previously unknown routes of transmission. Implementing these findings will improve swine health and productivity. An important achievement of part of this work has been the participation of local producers and veterinarians. Research results suggest regional spread of the pathogen, and therefore control strategies are best coordinated within common areas instead of isolated efforts at different times.

c. Source of funding: Hatch

d. Scope of impact: State and Multi-State

Key Theme: Biotechnology (RESEARCH)

MAES Plan of Work: Goal 1 Program 3, 7, and 8

The powerful tools of biotechnology are being used in several MAES sponsored research projects. The accomplishments of some of these projects are described in this report under other Themes, and under other Goals. Here are described some specific accomplishments related to accessing the potential of biotechnology to achieve Goal 1 objectives, as well as research analyzing the impact of biotechnology on agriculture.

a. Description
In Minnesota, the annual potato crop is worth approximately $125 million and is threatened by several diseases, including late blight. The Potato Pathology and Genomic Program has been analyzing wild potato species as potential sources of disease resistance genes. Materials were evaluated for resistance to late blight, and two promising species were identified. Researchers also contributed significantly to the cloning of a late blight resistance gene and are now developing strategies to enhance the gene's durability in the field. They have developed a laboratory-based, in vitro assay for late blight. In limited tests, the method has allowed the researchers to reliably distinguish between late blight susceptible and late blight resistant potato lines.

b. Impact
The impact on research of this in vitro assay method is it may reduce present research plot needs by 87 percent, allowing more efficient use of limited resources and substantially expanding germplasm screening capacity. For agriculture, the late blight resistance gene, RB, isolated from a wild potato, promises long-term durability in an agricultural setting. Under average Minnesota environmental conditions, grower savings could average $200-$400 per acre in reduced fungicide costs.

a. Description
In last year's report we discussed work begun to develop a genetic map of the *F. graminearum,* which causes Fusarium head blight (scab) and is a major factor limiting wheat and barley production in Minnesota and the Dakota. This year we can report on major progress on developing a physical map of the *F. graminearum* genome. The quality of the bacterial artificial chromosome (BAC) library used for fingerprinting is a critical factor for developing a genome-wide physical map.

b. Impact
--The first well-defined genetic map of *F. graminearum* has been generated
--Two BAC libraries for *F. graminearum* were constructed and fingerprinted.
--Two BAC library fingerprints will form the basis of the first physical map of the *F. graminearum* genome

--The BAC libraries developed were used to generate a complete sequence of the *F. graminearum* genome.

a. Description

A physical gene mapping system for corn is being developed using derivatives of oat and corn crosses. Two genes in strains of *E. coli*, if transferred to corn, conceivably would allow the corn feed to clear animals of the dangerous form of *E. coli*. Researchers have isolated and sequenced these genes, cloned them into appropriate vectors, and tested their expression on cell cultures of corn.

b. Impact

The explosion of genomic information and subsequent mapping of gene sequences will improve the breeding of major crops such as corn. The isolation of genes and subsequent transfer to useful lines of crops can provide varieties that grow in new environments or control human pathogenic diseases.

a. Description

Important policy and investment decisions regarding plant biotechnologies are occurring largely without data and analyses on the likely economic prospects of these technologies. U of M applied economics research is closely monitoring both the micro- and macroeconomic factors related to GM food production. The goal is to ascertain the best course of action for trade policy vis-à-vis GM foods, given the various environmental, commercial and quality of life factors that exist. The research could affect many areas of the U.S economy by encouraging trade with the rest of the world over the net 5-10 years as patterns of acceptance and regulatory schemes emerge. In part of this work, a preliminary assessment of a large data base on agriculturally related biotechnology patents was undertaken. The results of this assessment were presented to the World Intellectual Property Organization conference in 2003.

b. Impact

This research has found that thousands of R&D jobs have been created by the biotech industry, especially agricultural and food scientists. Those jobs pay considerably above average wage levels.

c. Source of funding: Hatch

d. Scope of impact: State and Multi-State

Key Theme: Ornamental/Green Agriculture (RESEARCH)

MAES Plan of Work: Goal 1, Program 11

a. Description
In past years Accomplishment and Results reports, we have described recent advances in our fruit and floriculture breeding programs, which has supported an industry in Minnesota that could not have existed without U of M developed cold-hardy varieties. We have discussed our apple research project and our chrysanthemum breeding projects specifically. This year we discuss our wine grape project, which is helping to create a small but viable wine producing industry in the state. In 1996 we introduced Frontenac grapes for red wine production.

b. Impact
The first grape variety for white wine production, LaCrescent, has now been released. While processing is generally viewed as a low value added activity for most fruits, it derives great commercial value when turning grapes into wine. In the mid 1980s, Minnesota had only a few wineries. However, with the introduction of new cold-hardy grape varieties, we now have ten wineries statewide.

a. Description
Work continues on landscape hardiness of over 100 types of ornamental grasses. Seed set, viability, and seed bank analysis has been studied from "wild type" selections of Miscanthus, an Asian-native grass. Superior selections of little bluestem were propagated and are being grown in three locations and at commercial nurseries for evaluation as possible new plant releases. The first selection of little bluestem will be released soon.

b. Impact
New native selections of grasses such as little bluestem can provide new sales for commercial businesses and pest resistant, low maintenance, landscape plants.

a. Description
Though perennial ryegrass has been used in Minnesota for a number of years, it is just recently that we have expanded our breeding efforts to incorporate winter hardiness and other traits that make it more suitable for the upper Midwest to use as turf and for the seed growers to produce in northern Minnesota. Seed has been harvested from approximately 75 lines and seeded into turf trials, and those trials are now being evaluated.

b. Impact
The economic impact of seed production of new perennial ryegrass varieties is estimated at $5 million dollars annually for northern Minnesota.

c. Source of funding: Hatch

d. Scope of impact: State and Multi-State

Key Theme: Plant Health (RESEARCH)

MAES Plan of Work: GOAL 1, Program 7, 8, 9, 12, 13

Plant diseases cause significant economic losses to Minnesota agriculture. Whether bacteria, fungi, or viruses infect plants, the resulting diseases kill or reduce the quality and quantity of crops. Losses are both direct, in reduced yields and crop value, and indirect, in the financial and environmental costs of disease control measures. Research to reduce those losses has shown progress this year relating to several diseases of a variety of important Minnesota crops.

a. Description

Production practices that include nitrogen fertilization have contributed to a marked increase in root rot and soil acidification in Minnesota's central region. That is where beans are the predominant cash crop. Seed treatments are common but ineffective controls of root rot, and can negatively impact nodulation and nitrogen fixation. Yields in some areas have declined by 50 percent in the last ten years, and a number of farms are being forced out of business. Researchers tested inoculant formulations using three different times of inoculation before planting, as well as three inoculation treatments, and fungicidal applications. Spectacular differences in nodulation and plant growth were evident throughout the trial.

b. Impact

Results of the research have created greater interest among farmers in the area about inoculation technologies, especially liquid inoculants. One organic farmer plans to inoculate more than 500 acres of beans in 2004, using the researchers' cultures. They have also been approached by a private company about using their selected strains in inoculant production, and by an Argentine company about further experimentation on inoculants formulations and fungicidal dressing.

a. Description

A Mexican strain of the potato late blight fungus reached Minnesota in 1995, and losses to late blight had reached an estimated $32 million by 1999. They have primarily been the result of excessive and unsustainable repeated applications of fungicide. Repeated fungicide applications also harm beneficial fungi, particularly those that feed on and control aphids. This may have contributed to recent re-emergence of aphid transmitted viruses that also plague Minnesota's potato industry. To forecast potato late blight development, Minnesota has needed an integrated network for collecting weather data for agricultural purposes. Researchers undertook a project to provide the industry with current weather information each morning during the growing season that relates the favorability of late blight forecasts and the locations of identified disease outbreaks. This can, at the least, improve the timing of applications, and, when weather conditions are unfavorable for the pathogen, the number of fungicide applications can decrease. By the beginning of May, 2003, researchers had built up the Blightcast network to include 27 weathering monitoring stations in various locations around the potato producing areas of Minnesota. The U of M Blightcast website was revamped in 2003 and made more accessible.

b. Impact

To assess the impact of this communication, researchers surveyed potato producers throughout the state to find out what kinds of fungicides they were using and the timing of applications. The survey found that average fungicide use was reduced to $92/acre, from $143/acre the previous year. Cost savings, based on production figures of 60,000 acres represent a savings of $3.1 million state-wide. If fungicide costs can be reduced through better timing of fungicide applications, information about weather and disease favorability is, and will continue to be essential.

a. Description

Researchers in Minnesota led a multistage effort to develop an economic threshold for soybean aphid in 2003. The economic threshold was determined to be 250 aphids per plant when more than 80 percent of plants have aphids. This threshold has a high degree of reliability when aphid populations begin to exponentially increase during vegetative to early reproductive growth stages. The proposed threshold provides a 7-day lead time before aphid populations exceed the economic injury level.

b. Impact

The economic threshold determined by this research will be the recommended threshold throughout the region. Soybean aphids caused an estimated $188 million loss in 2003 in Minnesota alone, so this information should help growers avoid losses. A user friendly web-based population growth prediction will be available in spring 2004 so a grower or consultant can use local weather to predict when soybean aphid populations will begin exponential growth. This will help prevent over-treatment of fields if temperature and other natural controls will prevent an aphid population from building to damaging levels.

a. Description

U of M oat breeders have released four recent Minnesota oat varieties with good disease resistance, including slow rusting, high yield and grain quality, with a range in maturity to cover the entire state.

b. Impact

Requests from Argentina and New Zealand to release Minnesota developed lines as forage varieties suggest the effectiveness of these lines' slow rusting trait. Further, a cooperator in Tunisia is also continuing to test about a dozen Minnesota lines for forage production there. All of these materials appear to have an adequate amount of slow crown rusting resistance, demonstrating that this resistance is not location specific. These results lend credibility to the hope that this resistance will be more durable than that of current varieties with traditional resistance.

c. Source of funding: Hatch

d. Scope of impact: State and Multi-State

Key Theme: Plant Production Efficiency (JOINT)

MAES PLAN OF WORK: GOAL 1, Programs 7, 12 and 13

a. Description

Precision agriculture gives producers the tools to use variable rate fertilizer spreaders for the rate specifically targeted for individual fields. Research has focused on the accuracy of this equipment. Spreader tests conducted on one farm showed that the machines often missed the rate that was desired by as much as 50 percent. The spreaders are better at delivering high rates of material (greater than 150 pounds per acre) and they have difficulty giving repeatable lower rates.

b. Impact

Based on average nitrogen application rates of 130 pounds per acre (for corn only) and a fertilizer cost of $211 per ton, nationwide savings may be $464 million with more accurate fertilizer application. Currently the estimated net loss in production due to inaccurate fertilizer rates and reduced yield ranges from $12 per acre to as much as $100 per acre, depending on how poorly fertilizer was distributed.

a. Description

Farmers perceive risk associated with integrated weed management in terms of yield, economic returns, and time and labor management. A key component to developing successful integrated weed management systems lies in the ability of the crop producer to align individual time and labor management issues with existing biological time constraints. To aid this process, researchers have taken a team approach to communicate the need for the adoption of integrated weed management practices by creating learning groups--each consisting of 10-to-15 people from sectors of the farming community who meet on a regular basis.

b. Impact

Implementing integrated weed management programs reduces farmers' exposure the short-term economic risks that result from poor timing of weed control practices and the longer-term risks that result from weed species shifts such as the development of herbicide resistant weeds.

a. Description

Research on canola, niger, and rye as a cover crop focused on both conventional and alternative production systems. Wheat, oat and soybean varieties were evaluated under organic production practices. By comparing yields of 2-year and 4-year crop rotations for four management strategies, research showed soybean was more responsive than corn to the expanded rotation length and documented the beneficial yield effects of the expanded crop rotation, which were masked by eternal inputs in certain management strategies.

b. Impact

Based on this research, producers have information about alternative crops and production practices. Canola variety selection by producers is closely tied to herbicide choice, and this research results offers producers non-biased comparisons of a number of

products. Based on this research, producers have fine-tuned their production practices in managing rye as a cover crop.

Extension Plan of Work: GOAL 1, Agriculture, Food, and Environment Capacity Area, Soybean Production, Soybean Aphid, Alternative/Specialty Crop, and Organic, Alternative, and Specialty Production Programs

a. Description

Minnesota produces over 5% of the world's soybeans. As a result, soybeans consistently rank as one of Minnesota's top three commodities in terms of cash receipts. Soybean sales brought in nearly $1.2 billion to the state's agricultural economy in 2001. In the past two years, Minnesota farmers have planted more acres of soybeans than any other crop. To continue to be competitive in the world market, Minnesota producers need to constantly adapt to new varieties, new production and marketing techniques, and new usages. Current challenges to Minnesota producers include iron chlorosis and the soybean aphid.

b. Impact

Educators are focusing on improving soybean producers' selection of more productive varieties, pest management—especially of the soybean aphid, soil fertility and water management, soil erosion control, and other important agronomic practices to improve the profitability and reduce the environmental impact of soybean production in Minnesota. They evaluated 29 varieties of special use soybeans in field trials during 2003. Educators estimated that producers can earn an average of $1.25 a bushel more for these varieties. At an average yield of 40 bushels/acre and 10,000 acres of special use soybeans planted in 2003, this premium added about $500,000 to these producers' cash receipts.

One educator in Southwest Minnesota reported that producers in his region have switched up to 80% of their acreage to SCN resistant soybean varieties. Another educator in the central part of the state estimated that 75% of the soybean acres in his region were sprayed for soybean aphid during 2003. Growers that did not spray for aphids lost an estimated 8.8 bushels/acre in yield. At $6/bushel, this is a loss of $52.80/acre. The regional educator in West Central Minnesota reported that there were 45,000 acres in his area sprayed at a cost of $9/acre or $405,000. Producers who sprayed increased their yield an average of 5 bushels. At $6.50 a bushel, spraying earned these producers an additional $1.5 million—an estimated net return of well over $1 million. In South Central Minnesota, almost every acre of soybeans—a total of 125,000 acres--was sprayed for aphids. The increased yield was estimated at an average of 12 bushels/acre, boosting farm income in this region by over $10 million.

c. Source of funding: Hatch and McIntire-Stennis

d. Scope of impact: State and Multi-State

Key Theme: Food Safety (JOINT)

MAES Plan of Work: GOAL 2, To ensure an adequate food and fiber supply and food safety through improved science based detection, surveillance, prevention, and education

a. Description

Chronic Wasting Disease (CWD) was detected in a captive bull elk in Aitkin county Minnesota in August 2002. While there is no evidence for CWD being transmissible to humans, hunters and consumers of wild game are concerned because of the association between bovine spongiform encephalopathy and a variant of human Creutzfeldt-Jacob disease. Ongoing surveillance is, therefore, important to assess potential risks. Using funding from the MAES, USDA, the Minnesota Department of Natural Resources, and private industry, a world class transmissible spongiform encephalopathy laboratory was built, equipped, and USDA accredited within two months. The Veterinary Diagnostic Laboratory has now tested more than 15,000 Chronic Wasting Disease samples.

b. Impact

The CWD response helped save the 2003 deer hunting retail and tourism season vital to Minnesota's rural economy. The laboratory is now being used to expand BSE "Mad Cow Disease" surveillance in Minnesota, helping to ensure a safe and wholesome foods supply and restoring and maintaining markets for U.S. beef and dairy exports.

a. Description

Lactic cultures can combat the growth of spoilage or pathogenic microorganisms by producing bacteriocins, which are small proteins that can kill other bacteria. The fact that they are proteins and readily digested by humans differentiates them from antibiotics. Perhaps the best known bacteriocin is nisin. Purified nisin could be considered a food ingredient and would therefore require specific approval by the FDA. Currently, it is only approved in the U.S. as an ingredient for processed cheese. However, the use of culture fermentates from nisin-producing lactococci is a very effective way of extending the shelf life and safety of foods. This is permitted by the FDA. To ensure consistent production of nisin by the culture, it is necessary to understand all the nuances involved in its production. Researchers have uncovered ways in which the culture switches production on and off. Understanding these mechanisms is providing the information to fine tune the fermentation to maximize production. Only a select few strains of *Lactococcus lactic* can produce nisin, and this limits the use of this antimicrobial compound. Engineering other cultures that are used in different foods to produce nisin would expand the uses for this effective compound.

b. Impact

Researchers were able to accomplish engineer other cultures, the first time that a bacterium other than *L. lactis* produced nisin. Understanding how the nisin gene systems function is enabling researchers to improve production and expand the avenues of use for this versatile protein.

a. Description

A field study on mastitis resistance to enhance dairy food safety was completed, describing the effect of infusion with an internal teat sealant when used with a long-acting antibiotic at dry off. This was the first study performed in North America to evaluate the efficacy of an internal teat sealant for the prevention of new intramammary infections during the dry period. Study results shows that use of this product resulted in a significant reduction in new infections during the dry period

b. Impact

This study has been published in the *Journal of Dairy Science* and the sealant has since been approved for use and is being marketed in the U.S. and Canada. This product offers dairy producers with a useful new tool to help reduce mastitis in dairy herds that should help to improve animal health, dairy enterprise profitability, and food quality.

a. Description

Cooking can destroy pathogenic microorganisms prior to marketing meat to consumers; however, this process has not been used because it develops a warmed-over flavor that consumers reject. Research demonstrated that the development of warmed over flavor could be suppressed in ground beef by lowering fat and adding starch and fiber. Meat not ground provided a greater challenge. Researchers tried vacuum tumbling in various types of brines that include starch, fiber and antioxidants and these demonstrated some improvement in resistance to warmed-over flavor while modestly improving nutrient content. Researchers also studied rinsing and chilling, which enhanced resistance to warmed over flavor, and improved the quality of meat. In addition, a significant reduction in cholesterol content was noted, further enhancing the functional food properties of beef. Combining vacuum tumbling with rinsing and chilling increased the effectiveness of the technique.

b. Impact

This project's results have developed a number of approaches designed to solve some of the most nettlesome problems in the meat industry, especially the beef industry. Precooking of meat is now a possibility and affords the processor a means of protecting consumers from diseases carried by meat. Lowering cholesterol content was thought to be virtually impossible, but has been accomplished by this research.

a. Description

With new regulations in the meat and poultry industry for the testing of Listeria in ready-to-eat foods, it is essential that these facilities have a rapid method to determine if the pathogen is present in their environment in order to control its presence in the food products. Researchers have developed a rapid detection assay for Listeria. They have developed a media that allows the rapid recovery of listeria from the samples, while inhibiting other contaminating organisms. They have been testing this assay and media with samples collected from meat and poultry facilities for analysis and evaluation in order to obtain AOAC approval.

b. Impact

The use of this assay for Listeria will help the food industry efficiently and economically control potential food borne outbreaks associated with this pathogen. With the knowledge

and techniques gained from this research, work is continuing on the development of a similar assay and media for the rapid detection of *E. coli*.

Extension Plan of Work: GOAL 2, Agriculture, Food, and Environment Capacity Area—Food Safety for Food Service and Wildlife Sport Food Safety Programs

a. Description

Minnesota families spend about half of their food dollars on meals away from home—putting them at risk for food borne illnesses. The majority of food borne illnesses reported in Minnesota are related to improper handling of food in restaurants and other food service businesses. An estimated 6.6 million diarrhea (including food borne) illnesses occur every year in Minnesota. Of those persons affected, 515,000 seek medical care, 48,900 visit an emergency room, and 30,500 are hospitalized. The Minnesota Department of Health estimates that 71% of recently reported food borne outbreaks is food service related. In addition, food borne illnesses can cost a retail food establishment more than $75,000 in lost income and additional expenses.

Extension's Food Safety for Food Service Program offers four training courses on food safety for the food industry. *ServSafe* was developed by experts in the food service industry to meet mandatory Food Manager Certification requirements. *Serve It Up Safely* is a food manager certification renewal course developed by Extension. It includes information on emerging trends, such as food allergies, food irradiation, and food recalls and since July 2003 is offered online, as well as in workshops. The *Safety and Service* course is geared toward food service personnel (workers rather than managers). And *Occasional Quantity Cooks* is designed to teach volunteers and non-profit organizational workers food safety for community events.

The Wildlife Sport Safety Program was a satellite downlink of *It's No Game: Safe Food Handling From Field to Table.* This program was very significant to Minnesota where fishing and hunting contribute $2 billion to the economy each year. During 2003, the spread of chronic wasting disease among large game was a major issue.

During 2003, 1,877 food managers and workers participated in the three food industry safety courses. 223 people who hunt and fish saw the *It's No Game* program at 17 satellite downlink locations.

b. Impact

96% of the food managers completing the *ServSafe* Program became certified. 92% of those who responded to a follow-up program evaluation indicated that they had applied at least one recommended practice to improve food safety. 35% said they had shared/taught what they learned to employees and co-workers. A recent Minnesota Department of Health analysis of food service inspection reports indicated an 18.5% reduction in critical violations in establishments with a certified food manager.

143 people participated in *Occasional Quantity Cooks* training during 2003. All participants indicated that they intended to apply at least one safe food handling practice.

82% indicated later that they had applied their new knowledge—for example, cleaning and sanitizing food preparation surfaces, keeping hands clean, calibrating thermometers correctly, cooking foods to the correct temperatures, cooling foods properly, and holding foods at the appropriate hot or cold temperatures.

It's No Game participants indicated on post-training evaluation that they substantially increased their ability to make safe food handling decisions about field dressing and storage of game and fish, as well as their understanding of current fish and game regulations.

References:
http://www.extension.umn.edu/foodsafety/index.html

c. Source of funding: Hatch and McIntire-Stennis

d. Scope of impact: State and Multi-State

Key Theme: Human Health (JOINT)

MAES Plan of Work: Goal 3: Through research and education on nutrition and development of more nutritious foods, enable people to make health-promoting choices

a. Description
Woodlands Wisdom is a collaboration with Tribal Colleges working since 1998 to address chronic health issues in Native American communities through culturally-based food and nutrition programs. These communities suffer from disproportionately high incidence of diabetes, heart disease, obesity, and other chronic diseases. Efforts by external professionals to offer help have met with limited success, due in part to a lack of appreciation for differing world views and culture. Part of the research related to this program has been on native foods. Antioxidant analysis was conducted on ten different indigenous bean varieties. Each of them tested higher in antioxidant capacity than corresponding market varieties. The Woodlands Wisdom project continues to explore cross cultural perspectives of research into food and nutrition issues. Other research to examine the nutritional status and dietary behavior of Native American youths has used focus groups with Native American youth to identify ways to increase physical activity and modify their diet.

b. Impact
As a result of this program as a whole, six Tribal Colleges now have faculty, programs and students in food and nutrition. The research described here involves integration of knowledge from marginalized communities. Nutrient analysis of a select sample of heirloom varieties of beans, corn, squash and wild rice indicate that these crops are of high nutritional value and may be useful as a food source in reducing risk of diabetes, heart disease, and obesity. This work gives hope to many community members who look to their own cultural traditions as part of the solution to contemporary health problems.

Research with Native American youth has resulted in creasing the physical activity of the youth in the study, and teaching them how to make healthier food choices.

a. Description

The body weights of Americans have increased dramatically over the past decade. U of M nutrition research to understand and control obesity has made progress in several areas. A study of dietary carbohydrates has shown that humans preferentially burn carbohydrates and therefore, the reasons why overeating carbohydrates leads to obesity are more complex that previously thought. Another project on food choices studied variables such as how hungry people are when they eat, and what they believe about their diet and health status. Findings were that increasing the interval between meals by 30 minutes led to a 2 percent increase in the percent of calories consumed from fat. This effect leveled off after 6.5 hours between meals. Eating in a sit-down restaurant led to consuming 3.5 percent more calories from fat than eating at home; eating in a fast food place increased the percent of calories from fat by 6 percent. In other research on defining a desirable dietary fiber intake, research has shown that dietary fibers isolated from oats and barley significantly lower serum lipids and should be protective against cardiovascular disease. Tests with a chemically-modified barley glucan fraction appear to have more potent physiological effects on serum lipids. This suggests these isolated fibers can help prevent cardiovascular disease. These isolated fiber fractions are well accepted in human subjects since only small amounts (6 grams per day) are needed to lower serum lipids.

b. Impact

This dietary research is contributing to an understanding of obesity and other health-related problems, and providing help to those who give nutrition and health advice. It is also influencing the design of nutrition educational programs.

a. Description

One project has been examining the effect of three different dietary fat sources—corn oil, beef tallow, and palm oil—on the development of atherosclerotic lesions. This work is significant because it extends the study of the effects of dietary fat on atherosclerosis from the use of intermediate markers such as cholesterol, to a disease endpoint. This is giving a much clearer picture of the effect of different dietary components in general, and dietary fats in particular, on development of atherosclerosis.

b. Impact

This study has allowed researchers to establish a powerful method for the study of how diet affects the development of atherosclerosis. This method is far superior to the currently used intermediate markers such as serum cholesterols. With the method, researchers can examine a number of different dietary interventions to determine their impact on risk of atherosclerotic diseases such as heart disease and stroke. Consequently, this will improve our ability to make accurate dietary recommendations to decrease the risk of heart disease and stroke.

a. Description

The field of probiotics is an important emerging sector of the dairy foods industry with tremendous growth potential. It involves including probiotic cultures in dairy products to

modulate consumer's intestinal flora for improved intestinal and overall health. Researchers have identified a specific probiotic culture that is associated with more positive effects on the large intestine than any other species and has ability to breakdown many dietary carcinogens. Researchers have identified and isolated a strain and deciphered the complete genomic sequence. The goal is to use this sequence to uncover probiotic relevant genes, but the sequence analysis has already revealed some interesting features. The most surprising was the extent of chromosome rearrangement within the two strains who share less than 98 percent sequence identity.

b. Impact

The inclusion of probiotic cultures in dairy products for the purpose of improving peoples' overall health is perhaps the sector of the dairy foods business with the highest growth potential. But to maximize this potential, it is imperative that the cultures used have scientifically validated probiotic attributes, which this work is establishing.

a. Description

A group of researchers have been working for the past three years on cancer-preventing compounds in cruciferous vegetables, such as watercress and cabbage. The goal has been to increase the level of these compounds by controlling the conditions under which the plants are grown, and to develop a regime with commercial applicability. Research has found that gluconasturtiin content increased in plants grown under long days, in plants supplemented with red light, and in plants treated with a brief red light period at the end of the day.

b. Impact

This research has led to a new concept of a line of branded produce certified to be high in disease-preventing compounds. This has potential of providing increased economic opportunities in rural Minnesota, as well as improving the health of all Minnesotans.

a. Description

Getting sufficient calcium during adolescence helps make sure there is adequate mineralization of the skeleton to ensure bone health later in life. Recent dietary intake data showed that calcium intake is below recommended levels for preadolescent girls. Intake of milk accounts for about half of the calcium intake for adolescent girls, and only 60 percent are meeting the recommendation for servings from the dairy product group of the Food Guide Pyramid. Research is focusing on what determines dietary intake of dairy and calcium-rich foods in Minnesota's Hmong youth and families. It has shown that practices parents use to make calcium-rich food available and cultural expectations of parents do have an influence on their children's calcium consumption.

b. Impact

Little research was previously available regarding influences on calcium intake by preadolescent girls, and parental factors affecting that intake. This research revealed effective interventions may include tasting sessions, development of asking skills so children can influence the availability of well-like foods both at home and school, and the promotion of regular eating habits to ensure that meals are not skipped. The goal is to design effective, culturally appropriate nutrition interventions for urban children and families. Improving children's dietary patterns will result in prevention of obesity and protection from chronic diseases later in life.

Extension Plan of Work: GOAL 3, Family Development Capacity Area—Color Your Plate Healthy With Fruits and Vegetables Learning Circle, Healthy Behaviors and Lifestyles: Eat and Be Fit Together, Healthy Behaviors and Lifestyles: Fun with Food and Fitness, and Research Updates Series for Professionals Programs

a. Description

Obesity in the U. S. is reaching epidemic proportions. The growing incidence of obesity among school-age children is a special concern of nutritionists, health care professionals, teachers, parents and grandparents. Extension is reaching out to these groups with current information on nutrition targeted to youth and older adults and to health care and education professionals and encouraging action at the community level. More than 6,700 youth and adults participated in these programs during 2003.

b. Impact

The *Color Your Plate Healthy with Fruits and Vegetables* Program targeted older adults (age 55+). Program participants averaged three key behavior changes each as a result of the information received. 56% of the program participants indicated they were subsequently trying to eat 5-9 servings of fruits and vegetables daily. 36% indicated that they now realize that eating at least five servings of fruits and vegetables daily reduces their long-term risk of cancer, heart disease, etc. 28% subsequently were aware that fruits and vegetables provide them with vitamins, minerals, fiber, and protective factors (phytochemicals) and 48% had learned that the deeply colored fruits and vegetables are the richest in protective factors. 28% now wash produce with water, rather than soap or bleach.

The *Healthy Behaviors and Lifestyles: Eat and Be Fit Together* Program was designed for high school athletes. Over 600 participated in this program in 2003. All of them planned to make dietary changes subsequent to the program. 93% reported eating better snacks before sports events and drinking more water during them. Other youth athletes reported more frequent washing of hands before preparing and eating food, reading nutrition labels, eating breakfast every day, eating vegetables every day, and trying new foods.

One Minnesota elementary school was a pilot site for the new JIFF (Jump into Food and Fitness) curriculum developed by the Michigan Cooperative Extension Service for kids age 9 to 12. This curriculum focuses on healthy lifestyles for kids with nutrition education and physical activities. Nine adults and youth were trained in the curriculum content and presented six two-hour sessions to kids enrolled in the Summer School Child Care Program. Kids liked the JIFF activities so much that 100% improved on post testing of their knowledge of nutrition and the need for physical activity. 100% also said they tried new foods during JIFF that they would eat again—for example, summer squash, sugar snap peas, whole-wheat bread, star fruit, and craisens. More than half of the JIFF kids also reported sharing the take-home activities with their parents. The JIFF Program proved so popular that school officials asked that it be continued there.

The *Research Updates Series for Professionals* attracted over 1,300 health and nutrition specialists and parents and grandparents. Two conferences were held in Minnesota during 2003, one of them, "Overweight Issues in Childhood: Role of Environment and Community," in collaboration with the Iowa Cooperative Extension Service. 100% of the participants rated the 5-hour conference as excellent, very good, or good and all planned to use the information in their professional outreach. More than half of the conferees indicated they were interested in a future conference focused on best practices for addressing obesity in children for families, communities, and schools. The second conference was entitled "Minnesota Takes Action for Healthy Kids: What Families and Communities Can Do." The 82 professionals, parents, and grandparents at this conference rated it excellent or very good. Over half planned to teach what they'd learned to others and to take action to improve the lifestyles of children and families in their workplaces, schools, or communities—such as questioning school lunch options, vending machine options, increased physical activities, etc.

As a result of these conferences, health and nutrition specialists are more aware of the health and nutrition resources that Extension has to offer and the role that Extension educators can play. The local media have requested more information on childhood obesity. Professionals who attended the two conferences last year have reported that they are using the information they received. School nurses in one county reported that they have added time to their meeting agendas to discuss strategies for reducing child obesity by changing the foods available and the physical activities in their schools. One school formed a Healthy Lifestyle Task Force to take action on cafeteria and vending machine food options.

Reference:
http://fscn.che.umn.edu/nutrinet/

c. Source of funding: Hatch and McIntire-Stennis

d. Scope of impact: State and Multi-State

Key Theme: Agricultural Waste Management (JOINT)

MAES Plan of Work GOAL 4, Program 6: Animal Waste Management

a. Description
Odor emitting from open manure storage facilities has been a problem for years with no cost effective methods available for farmers to use. Animal producers are beginning to use advanced techniques to treat liquid animal wastes in order to meet the increasingly tighter environmental regulations, and solid-liquid separation and aeration has drawn the greatest attention. It concentrates the organic solids and nutrients, making it possible to

apply the nutrient-rich fraction to crops during the growing season. Producers had already recognized the benefit of using separation and aeration to treat manure for odor control, but combining separation with aeration had not been sufficiently studied to determine levels and combinations of separation and aeration. This research determined that reducing manure solids content prior to aeration treatment is critical in reducing the potential for odor generation during the subsequent storage period.

b. Impact

The results obtained from the project have paved the way for swine producers to bring this issue to a conclusion at an affordable cost. The project not only provides evidence and confidence that swine manure odor can be reduced to a satisfactory level with the combined treatment of solids-liquid separation and aeration, but also offers key information in terms of how to select the equipment and design the system to minimize the capital cost. An evaluation of an aerator running on the lagoon of a cooperating farmer's farm, for example, revealed that it would take three months of continuous operation to achieve an odor free storage. The aeration cost per pig produced is about $0.76.

a. Description

In a two year project, five Minnesota counties were selected to evaluate the OFFSET (Odor from Feedlot Setback Estimation Tool) method on commercial farms in these counties. Regarding all observations, the observed odor intensity was significantly higher than the predicted.

b. Impact

The results of the OFFSET project is aiding in the improvement and use of this siting tool to establish objective setback distances between animal production sites and local residents and businesses. Animal producers are also gaining important information from OFFSET on the impact of odor control technologies on their production facilities.

a. Description

Improper handling of milk house wastewater can negatively impact environmental quality. Many small and mid-sized dairy operations in Minnesota need to upgrade their milk house and wastewater handling systems to comply with Minnesota Feedlot Rules, which prohibit discharge of milk house wastewater with no treatment. Producers need systems that perform reliably, meet environmental regulations, fit their management practices, and are economical to install and operate. Researchers have been evaluating alternative systems for handling milk house wastewater.

b. Impact

Small and mid-sized dairy producers, those with less than 200 cows, account for about 88 percent of the total dairy operations in Minnesota based on USDA data. This research is providing these producers with installation and operating cost information as well as performance and management information. The evaluation is giving this producer group the necessary tools to choose the best system. Outreach efforts are providing producers, engineers, Extension educators, and technical staff practical and technical information on the systems used in the study. Performance, cost and management information gathered is being disseminated statewide.

Extension Plan of Work: GOAL 4, Manure Management Education

a. Description

Livestock production is a major segment of agriculture in Minnesota. In addition to dairy, Minnesota farmers are major producers of beef, swine, turkeys, broilers, and laying hens. The manure generated has the potential to negatively impact air and water quality in the state. Federal, state, and local regulations are designed to protect natural resources. Livestock producers are required to develop and implement manure management plans. Research continues on ways to better utilize animal waste in order to reduce air and water pollution. Extension educators provide group sessions on properly disposing and utilizing animal wastes, as well as extensive one-on-one assistance to individual producers developing manure management plans.

b. Impacts

Educators continued working with livestock producers to bring them into compliance with federal, state, and local manure management regulations. State feedlot officers are reporting that many more Minnesota farmers now have completed plans. Educators reported working with more than 5,400 livestock producers on manure management in 2003. Many producers participated in workshops and small group sessions where they learned the BMPs of nutrient and manure management, including training on manure sampling, interpretation of test results, and proper calibration of manure disposal equipment. One educator reported also providing producers in his region with a notebook of manure management resource materials. These materials included: "Land Application of Manure: Tools and Resources," "Planning and Record Keeping Guide for Land Application of Manure," "Minimum State Requirements Checklist for Manure Management Plan Components," "Applying Manure in Sensitive Areas," "Fertilizing Corn in Minnesota," "Livestock Manure Sampling," "Calibrating Manure Spreaders," 'Soil Sampling as a Basis for Fertilizer Application," "Certified Manure Testing Laboratories," and "Fertilizer Recommendations for Agronomic Crops." One educator alone helped 126 individual producers prepare manure management plans. Campus-based faculty provided several individual consultations on installing methane digesters on dairy farms. Economic projections helped to convince several producers that taking this step was not in their best interests.

Manure Management Workshop participants all reported that they are now sampling for N, P, and K on a regular basis. One regional educator conducted a nitrogen field plot study with five local producers to determine the optimum level of N application. N was applied at 0, 60, 90, 120, 150, and 180 pounds per acre. The optimal economic rate turned out to be 90-120 pounds. Yields did not improve significantly at higher rates. The results of this field study were shared with other producers in the region.

c. Source of funding: Hatch and McIntire-Stennis

d. Scope of impact: State and Multi-State

Key Theme: Natural Resources Management (RESEARCH)

MAES Plan of Work: GOAL 4: Maintaining Forest and Natural Resources

a. Description
U of M natural resources researchers have released Version 4.0 of their MapServer software. The software is already being used by thousands of organization around the world. The new version has several upgrades, including supporting output of Shockwave Flash and PDF documents, 24-bit images, and processing raster data. MapServer has received many accolades in the GIS literature and has been labeled the best OpenSouce GIS software available.

b. Impact
A flexible, open source software tool for spatial data distribution and analysis promotes use of satellite imagery and the Internet-WWW for resource management decision-making and public education.

a. Description
Minnesota has more licensed anglers per capita than any other state in the union. However, fish populations in some areas are declining, and sometimes lack genetic diversity. U of M researchers are using molecular genetic tools to help deal with those issues. To evaluate the success of stocking walleye into the Red Lakes one project has been using genetic markers. Genetic profiles of the stocking source and the natural walleyes were determined for eight DNA markers. Over five years, tissue samples were taken from fish and their genotypes were determined to find if they were from natural reproduction or from stocking. Results indicate that more than 60-to-80 percent of young walleye resulted from stocking. Results from the genetic markers compare favorably to results from chemically tagging the stock fish; estimates of the percentage of stocked fish from the two methods have been less than 10 percent apart. Therefore, genetic markers may provide a life-long tag for evaluating survival of stocked fish and allow evaluation of their success in spawning the next generation.

b. Impact
This work has broad utility to Minnesota lakes in general, but one immediate specific impact: If restocking the Red Lakes with walleye is successful, the tribal fishery, which was the last commercial walleye fishery in Minnesota and has been closed for ten years, may be reopened. This would provide jobs and incomes for band members. Opening the Red Lakes for walleye fishing by band members would not only be an economic benefit, but a cultural one as well.

a. Description
To help inform policy makers, researchers conducted a study to determine the extent to which forest landowners incur additional financial costs by following Minnesota's timber harvesting guidelines. They found that following the guidelines decreased stumpage bids $2.66 per cord (10 percent) and the merchantable timber volume by 2.4 cords per acre (8

percent) while increasing the time required to prepare a timber tract for auction by 57 percent. The total costs of incorporating the guidelines into timber sales were found to average $143 per acre (reduced stumpage prices: $71/acre; value of residual trees: $65/acre; additional timber sale prep time: $7/acre). These findings were surprising, and revealed that forest landowners were absorbing a significant cost for helping to maintain the quality of Minnesota's natural resources.

b. Impact

The results of the research have been communicated to the Minnesota Forest Resources Council, as well as to forest landowners. The eventual impact may be the creation of incentives for forest landowners to follow the guidelines. For the first time the actual costs to forest landowners have been quantified and serve as a basis for identifying strategies to encourage greater use of sustainable forestry practices. The researchers are now planning a follow-up study to determine the influence forest management guidelines had on loggers willingness to pay for stumpage, relative to other tract and sale characteristics.

c. Source of funding: Hatch

d. Scope of impact: State and Multi-State

Key Theme: Water Quality (RESEARCH)

MAES Plan of Work: Goal 4, Program 5: Water Resource Management

The recent accomplishments reported here ranges from projects using biotechnology techniques to support water quality, to applied research to improve water quality in Minnesota, including not only the state's many lakes, but also its important waterways, the Mississippi and Minnesota rivers.

a. Description

A group of U of M microbiologists has developed DNA fingerprinting methods to determine sources of fecal pollutants in water and soils. As a result, a large library of DNA fingerprints from E. coli bacteria isolated from animal sources has been created.

b. Impact

The project helps farmers and public agencies improve water quality, and the technology developed by this project has global impacts in improving the environment.

a. Description

The Minnesota River is one of the most polluted waterways in Minnesota, with sediment and phosphorus being primary concerns. Researchers are working with a coalition of producers, state and county agency personnel to accelerate the voluntary adoption of best management practices (BMPs) in the Minnesota River Basin. The results of this project indicate that many BMPs increase profits while achieving environmental improvements. In particular, the largest economic and environmental benefits to date are achieved by

moving from conventional tillage with high application rates of nitrogen in the fall to conservation tillage with lower nitrogen application rates in the spring.

b. Impact

A positive and intriguing result of this study is that incremental economic gains can be achieved with adoption of the practices evaluated. The results highlighted the need for an integrative approach at both the policy and at the producer levels to ensure that nonpoint pollution control regulations lead to holistic improvements in water quality. One impact from this study was the development of the project described below—a three-year paired watershed study in Nicollet County, with was funded by the U.S. Department of Agriculture in 2001.

a. Description

The researchers are directly working with about 30 farmers to improve their farm management practices and local water quality. Producers had serious reservations about portion of a Minnesota Pollution Control Agency report that estimated that 20 percent of the sediment arose from stream bank erosion. In reality, subsequent direct measurements and surveys of stream bank erosion showed that 40 percent of the sediment originates in stream bank erosion. The report concluded that land-applied manure accounted for 20 percent of the phosphorus load carried by the Minnesota River. Subsequent research showed that land applied manure accounts for 35 percent of the phosphorus load. Now that producers are satisfied that the sources of pollution are accurately known, they wish to begin improving water quality through paired watershed studies to evaluate the costs and benefits of BMP implementation.

b. Impact

Many farmers in the project are improving their production management strategies as well as improving the quality of soil and water. Farmers in the treated watershed decided that they wanted to begin making changes in their farm management practices to improve water quality. Contracts to implement those changes were signed with farmers managing over 80 percent of the cultivated land in the treated watershed. One example of this is that several farmers collected samples on their farm and the results showed a wide variation in the phosphorus fertilizer requirements across the farm. This information resulted in improvements in fertilizer use efficiency, which reduced phosphorus losses to the groundwater while increasing crop yields.

a. Description

This project has demonstrated the advantages of using digital multispectral satellite imagery for monitoring environmental and natural resources in Minnesota. Techniques to monitor lake clarity, a key indicator of water quality, have been developed and used to classify over 10,000 lakes. This method provides a cost effective way to obtain information on nearly all of the site's lakes and the methods are being transferred to the State for future monitoring. Using 19 Landsat images that covered the entire state of Minnesota, researchers produced a census of water clarity in more than 10,500 lakes across the state for the early 1990s. Nearly all lakes over 20 acres were included in the census. A similar census has been completed for the early 2000s. Images were calibrated using ground-based measurements of Secchi disk transparency collected by agencies or citizen monitors. Results from the two lake censuses have been used to

produce a database of lake clarity data in Minnesota that is available to the public on the Internet. The database allows one to search for a lake of interest on a map, and access clarity information. The lake clarity procedure also was adapted for use with high resolution images from the IKONOS and Quikbird satellites. As a demonstration, an IKONOS image of Eagan, Minnesota was processed and the water clarity of 375 ponds in the city was determined. Only 14 of the ponds are large enough to be assessed by Landsat imagery.

b. Impact

Satellite remote sensing has proven to be more cost-effective than conventional approaches for acquiring information on natural resources. Lake monitoring is now done on only a few hundred lakes; it would be technically and economically infeasible to monitor all lakes by conventional sampling and surveys. Instead, using this technology, all of the lakes larger than 10 to 20 acres for the entire state can be classified at modest costs.

a. Description

With approximately 30 percent of Minnesota residents served by individual sewage treatment systems, there was a need to evaluate small-scale on-site technologies for their performance under cold weather conditions. Much of the on-site treatment technology was developed in climates significantly warmer than Minnesota. Two research sites were established to monitor an aerobic treatment unit, a drip distribution system, and a system consisting of two recirculation sand filters, four peat filters and four constructed wetlands. These systems were evaluated as pretreatment devices for their ability to remove contaminants.

b. Impact

The research showed that these systems are a viable choice in Minnesota for on-site wastewater treatment, but because of their inability to meet the 200 coliform standard fecal coliform consistently, additional soil treatment is essential. These conclusions inform a strong outreach education program on the selection, maintenance and use of sewage treatment systems.

c. Source of funding: Hatch

d. Scope of impact: State and Multi-State

Key Theme: Family Vitality (RESEARCH)

MAES Plan of Work: GOAL 5: Empower people and communities, through research-based information and education, to address the economic and social challenges facing our youth, families, and communities.

a. Description

More than 100,000 Southeast Asian families now reside in Minnesota. Many live in extended multigenerational families adversely affected by war, refugee camp life, and

resettlement. U of M Family Social Science researchers have developed a curriculum that is the first of its kind to help Southeast Asian families throughout the U.S. reestablish cultural and generational bonds that have been strained from large-scale displacement of the past three decades. The curriculum was tested in pilot parent education programs in all four Southeast Asian groups. Focus groups with facilitators revealed that the culturally relevant family stories in video and written formats are used successfully to elicit problem-solving discussions among Southeast Asian parents.

b. Impact

The Southeast Asian parent education curriculum based on research on Southeast Asians in Minnesota that began in 1987 has improved communication between parents and adolescents, and also has brought a better understanding of the complexities of bicultural parenting amongst parent educators and others who interact with Southeast Asian families. The long term impact of improved communication among families is a decrease in negative outcomes in Southeast Asian adolescents in terms of crime rates, gang memberships, runaways, dropouts, and truancy

a. Description

Research on children adopted as infants in the U.S. under confidential adoption and open adoptions has found no evidence that contact with birth family members is harmful to adopted children, either during middle childhood or adolescence. Furthermore, contact may be helpful insofar as it promotes satisfaction and opens the door for a collaborative relationship with birth family members. On the other hand, open adoption makes family relationships more complex and increases the need for communication and flexibility.

b. Impact

This longitudinal study of adopted children has had policy implications, and the researchers are communicating these with decision-makers. Project results were presented to high-ranking adoption officials in London, and research results are being considered as policy decisions are made in the United Kingdom, for example.

a. Description

U of M research on family boundary ambiguity has been ongoing since the late 1970s and, while there has been much research on the effects of loss per se, this project has been the first to study unclear loss. It has surfaced a new risk factor in family stress theory. It helps explain why even strong families are often unable to function. Findings indicate that ambiguity complicates loss, creates ambivalence, and immobilizes families. Specific findings have developed into several projects, such as one focusing on successful care giving for Alzheimer's disease patients. Findings to date provide clearer direction on how to keep dementia patients at home as long as possible without negative effects on caregivers. Most recently in the aftermath of 9/11, when thousands of family members vanished in the World Trade Center terrorist attacks, U of M researchers teamed with family social scientists in New York to help families deal with their loss and devastation.

b. Impact

What the MN-NY Ambiguous Loss Project did in the field on emergency basis after 9/11 has now been documented by the team, making it possible for researchers to test the model used, and improve it for future disasters when family members go missing. This

work has had international impact as well. The International Committee of the Red Cross heard about the work being done here and asked the lead researcher to present a three-day seminar on ambiguous loss and boundary ambiguity to professionals and community leaders in Kosovo. These professionals are trying to ease the distress of 4,000 families with kidnapped and missing loved ones after the ethnic cleansing of the late 1990s.

c. Source of funding: Hatch

d. Scope of impact: State and Multi-State

Key Theme: Family Resource Management (RESEARCH)

MAES Plan of Work: GOAL 5; Empower people and communities, through research-based information and education, to address the economic and social challenges facing our youth, families, and communities.

Research to help Minnesota families manage their financial resources to improve their economic stability and quality of life has focused on several different segments of the population of Minnesota. It has also examined the effects of governmental policies on families' economic health. Impacts from this research have been wide-ranging:

a. Description
Researchers concluded an analysis of Family Assets for Independence in Minnesota (FAIM), which is a state, federal, and privately funded pilot program to help low-income families. FAIM is part of the national movement for Individual Development Accounts, a government and privately funded program to promote savings and asset development for the working poor. The FAIM staff disseminated the findings and revised the program based on our research-based recommendations.

b. Impact
Our research informed the FAIM program and indirectly contributed to the economic outcome of the pilot program. Results showed that the 428 account holders had deposited $361,533 into FAIM savings accounts. By the end of the reporting year, it is estimated that account holders will have saved $671,040. At the time of the evaluation, 51 families had closed on homes, 22 small businesses had been launched, and 33 participants were using their accounts to fund college participation. Based on the success of the program, the Minnesota Legislature has made the asset building program permanent.

a. Description
An evaluation of an educational program to teach high school students manage their finances has confirmed the value of the program for increasing the financial skills of teenagers.

b. Impact
The evaluation revealed that 56 percent of the students saved an average of $30 per week. Therefore, the 5,000 students who took the course in one year saved about $150,000 in Minnesota. This is significant, as the U.S. has the lowest savings rate of any industrialized nation in the world. If young people develop good savings habits early in their lives, they are apt to be more secure financially and less likely to declare bankruptcy.

a. Description
Other research focused on family business-owning couples. The two types of business tensions that were reported to have the highest levels of tension were unfair workloads among family members due to the family-run business, and competition for resources between family and business. These stresses can affect family stability, the research

showed. Those business managers reporting very high tension levels had statistically lower family integrity scores.

b. Impact

As a result of the family business study, researchers developed a conflict identification tool that is used as an assessment tool with family business consultants. When disagreements, tensions, and conflicts arise in family businesses, it is critical to address them. Reducing family tension by only 4 percent would increase annual family business revenue .04 percent, or $400. If 10 percent of business owning families reduced their family tension by 4 percent, family business revenue in the U.S would increase $389 million.

a. Description

Between 2000 and 2050 the number of elderly will nearly double nationwide. Long term care can threaten the financial security of individuals, their family members, as well as state and federal governments. The more individuals assume responsibility for paying for long term care, the greater chance for financial security in later life and less reliance on public resources. A study conducted by U of M family resource specialists has helped understand who does and does not enroll in employer-sponsored group long term care. This has helped to inform macro level policy and practices as well as prevention education. Specific findings provide insight to help better design employer benefit packages, and improve communication with consumers. State governments and other employers considering offering long term care insurance have requested copes of the research report. Findings have also provided the foundation for the development of decision-making tools for family members. These educational resources are used nationwide with the aging population as part of the Financial Security in Later Life Cooperative Extension National Initiative.

b. Impact

Average costs offer some insight into the economic value of individuals planning ahead to protect themselves against the cost of long term care. Assuming individuals either purchase long term care insurance and/or save sufficient resources to pay their own way, state and federal governments would save approximately $60,000/person for an average one year skilled nursing home facility stay, as well as more than $20,000/person for average home care expenses.

a. Description

A multi-state research project to evaluate the quality of life of low-income rural residents has provided a base book report, and a website for sharing of public information. It has provided a better understanding of the challenges facing rural low-income families. A policy brief was distributed to Congress and the public. The research has highlighted findings that minority families, especially Latino families, are not applying and receiving earned income credits when eligible. Close to 200,000 Latinos reside in Minnesota, making them our largest minority population. Other research evaluating public sector impacts on state economic growth has confirmed that there are significant differences in the welfare populations and welfare behavior between rural and urban counties in Minnesota, indicating that welfare policies that take explicit note of the location of the welfare recipient will help make welfare policy more effective.

b. Impact

Research findings confirmed that lack of accurate information for eligible low-income families living in rural communities is the primary factor preventing them from receiving assistance. Other economic research confirmed that a substantial number of other eligible households do not make use of income tax based income assistance such as the federal earned income credit, or Minnesota's working family credit. This research helps identify the groups that are not participating in the program, providing information which can help such tax credit programs be more successful substitutes for direct welfare assistance.

a. Description

Children of divorced and unmarried parents have the greatest risk for living in poverty. Research to evaluate the Minnesota child support guidelines by comparing financial outcomes for fathers, mothers, and children at divorce has shown an improvement in realizing two of the three policy goals underlying child support guidelines. However they have not protected the financial well-being of children.

b. Impact

In 1999 almost 270,000 Minnesota children received services from county and state child support offices, and a total of $433 million dollars in child support was collected and disbursed. Results from the researchers'1986 study and its two-follow-up surveys including this most recent one have indicated that children received less money than the ordered amount. Results also showed that the money required for costs of food at home required 78 percent of the child support income received. These results show that factual information from court cases concerning child support orders could lead to changes in policies and practices that will protect the financial well-being of Minnesota children.

c. Source of funding: Hatch

d. Scope of impact: State and Multi-State

Report on Stakeholder Input Process

A. Actions taken to seek stakeholder input that encourages their participation

In the summer of 2003, the College of Agricultural, Food and Environmental Sciences (COAFES) and the Minnesota Agricultural Experiment Station (MAES) co-hosted eight listening sessions throughout the state to gain insight and input into how the college and the Experiment Station can strengthen their vision and priorities. More than 700 persons attended the sessions and shared what was important to them, their families and communities.

The listening sessions help ensure that COAFES and MAES are meeting research, teaching, and engagement needs in the state that bring benefit to Minnesota citizens. Input from citizens and from students, faculty and staff members provide the COAFES and MAES guideposts for decision making on the best uses of financial, physical and human resources.

As part of one of the few land grant universities in an urban area, COAFES is uniquely positioned to be a leader in addressing environmental concerns caused by urban growth. Using the University of Minnesota Outreach, Research and Education (UMORE) Park and the Arboretum as a research and outreach site, the "Serving Urban Communities" initiative developed programming to position COAFES as a center of excellence to solve environmental problems related to urban development. A national conference was held in Minneapolis in May 2003 to identify research needs and potential funding. Obtaining input from stakeholders and other supporters of urban stormwater programs has been an important aspect of this program.

The College of Human Ecology Advisory Council meets twice a year and different members are engaged in different ways that transcend all areas of the college (i.e., one member participated on the newsletter advisory board; another member attended the legislative update; another member is referring students to the college; another member will be the commencement speaker; and yet another member is working with Constituent Relations on a strategic plan).

The Department of Food Science (jointly administered in the College of Human Ecology and COAFES) has an Advisory Council that meets annually, which focuses on critical issues and listens to responses of relevance and prioritization of those issues.

The School Work has a Gamble-Skogmo Child Welfare Advisory Board that meets twice a year for planning policy makers and social service agencies. The Center for Advanced Studies in Child Welfare Advisory Board meets twice each year with representatives from the legislature and policy makers. The Institute on

Domestic Violence in the African-American Community has an eight member all African American board.

Several CNR, COAFES and Extension faculty serve on the University's Regional Sustainable Development Councils that allocate funds for research and extension projects that link the University to local issues, especially in agriculture, natural resources, tourism and community development. By serving in this capacity, they become more closely aligned with the people and issues out in the state.

B. Brief statement of the process used to identify individuals and groups who are stakeholders and to collect input from them.

As stated in Section A., stakeholders were identified in many ways: college advisory councils, political officials, mailing lists for Experiment Station and college publications, mailing lists for constituents, mailing lists for under-represented/underserved populations, and mass media announcements to the general public.

C. Statement of how the collected input was considered.

The deans and/or associate deans for research in COAFES, CHE, CNR, CBS and CVM meet as an Experiment Station Executive Council each month to identify research priorities, set research policies, plan programs, and discuss stakeholder input for inclusion in the policy and planning decisions. Important new research and programs have been initiated due to excellent stakeholder input.

D. Statement regarding the usefulness of the stakeholder input process in refocusing and reaffirming priorities or in identifying emerging issues.

The stakeholder process keeps researchers and administrators connected with the general public, external constituents, and external partners. It influences the use of resources and the direction of programs in many ways (as detailed above).

Update on Program Review Processes

The review process for Hatch supported projects has not changed since the original Plan of Work was written.

The Department of Food, Science and Nutrition underwent a program review in 2003.

Evaluation of the success of multi-state, multi-institution, and multidisciplinary activities, and joint research and extension activities

Success of multi-state, multi-institutional and multidisciplinary activities

Faculty in the Minnesota Agricultural Experiment Station participated in 138 multi-state projects and committees. CRIS progress reports have been filed to document Minnesota's participation in the projects. Participation in these projects by our faculty provide the opportunity to share resources and expertise across the North Central Region and as well throughout the nation.

Following are examples from the colleges in the MAES:

The "Program in Agricultural, Food, and Environmental Ethics" offers educational programs and courses, conducts original interdisciplinary research, and fosters public discussion and debate about food consumption, the human relationship to the nonhuman environment, and the ethics of agricultural research, production, and distribution. The goals of the program are threefold: to formulate and identify questions of ethical significance to Midwestern residents concerning agriculture, food, and the environment; to develop and evaluate moral theories and principles related to these questions; and to explore the application of these moral theories and principles by individuals and groups.

The Water Resources Center (WRC) conducts and funds research and outreach related to water resources in the state of Minnesota. As the focal point for a broad range of research, education and information exchange related to water resources, the WRC links faculty and student researchers with practicing professionals and citizens to address water resources issues. This facilitates effective delivery of research results to citizens and decision-makers and opens new avenues for multi-disciplinary and interagency partnerships.

The Center for Animal Health & Food Safety is focused on the food system from the farm to the consumer. The Center assures food safety by aggressive risk communication, applied research, integrated animal and public health surveillance, expanded educational programs, and facilitation of creative prevention and quality assurance strategies involving producers, processors, distributors, retailers, food service and consumers.

The JASON Project, a distance learning program with the Bell Museum of Natural History, in CNR, emphasizes the National Science Foundation's goal of increasing the number of youth, particularly from underrepresented populations, interested and excited about science. The program highlights educational, age, ethnic, and gender diversity of host scientists. By providing role models of diverse background, they show that science is fun and for everyone.

The Design and Technology Center for Changing Landscapes is a partnership between the College of Architecture and Landscape Architecture and the College of Natural Resources focusing on the environment, natural resources, and land use management. The co-directors have communicated with state and regional agencies and organizations to identify issue areas. They are also identifying linkages between issues and stakeholders and developing a strategic plan as well as a web site.

The "Native American Research and Outreach Center," a new partnership between the White Earth Tribal College and COAFES, was designed to establish a model center for indigenous inquiry and learning focusing on water issues in the region.

The Office of International Programs in COAFES implements programs and creates partnerships that address agricultural, food and environmental sciences issues internationally and has partnerships with countries from China to Russia to Senegal.

The New Immigrant Farmers Program, based at UMORE Park (part of the MAES Research and Outreach Center system), is a successful program that provides land, tools and gardening advice to new immigrants from traditionally agricultural cultures (Somalia, Southeast Asia, East Africa and others).

In the College of Veterinary Medicine (CVM), the Transition Management Facility is a unique collaborative project with a dairy that gives veterinary students hands-on experience with large populations of dairy cows in the weeks before and after giving birth. The facility, an hour outside the Twin Cities, also provides opportunities for educating veterinary practitioners, conducting clinical and applied research, and showcasing new management techniques for the dairy industry.

Working with the University's School of Public Health, CVM started a unique four-year joint DVM/MPH degree program. This innovative program, which allows veterinary students to receive both degrees in four years, was designed to meet the rising national need for public-health veterinarians to work in areas such as food safety, emerging infectious diseases, and bioterriorism.

To ensure the prudent use of drugs in food animals, CVM developed a "best practices" model in cooperation with the Minnesota Veterinary Medical Association and the dairy industry.

To continue its support of the turkey industry, CVM faculty developed an avian pneumovirus vaccine that was approved for use by the USDA.

To promote the health of Minnesota's wildlife, the Veterinary Diagnostic Laboratory implemented Chronic Wasting Disease diagnostic testing and surveillance. This helped save the 2003 deer hunting retail and tourism season, which is vital to Minnesota's rural economy.

A researcher in the Department of Family Social Science has worked extensively on a multi-state research project through her MAES research. This project involves 15 other universities and disciplines in data gathering for a mega database that may then be used for research projects related to welfare reform.

A researcher in the School of Social Work has had a 20-year research partnership with the Wilder Foundation on a Domestic Abuse Project in Minneapolis and has written about key aspects of success in community partnering.

The Department of Food Science and Nutrition has worked with other units across campus on a project called SotaTech (short for Minneosta Technology). This project crosses department and college lines in a multidisciplinary effort, e.g., horticulture, medicine, food science and nutrition.

The Department of Design, Housing and Apparel is partnering with the American Society of Interior Designers in an extensive web based clearinghouse for design and human behavior research called InformeDesign (www.informedesign.umn.edu).

Success of joint research and extension activities

The MAES is governed by an Executive Council comprised of the deans and associate deans in the Colleges of Agricultural, Food and Environmental Sciences; Human Ecology, Biological Sciences; Veterinary Medicine; and Natural Resources. The Dean and Director of the University of Minnesota Extension Service serves as an ex officio member of the council and attends all meetings. The council oversees budget and policy decisions and establishes research priorities.

The MAES continues to receive $1.6 million each year from the state legislature for Rapid Agricultural Response research projects. To qualify for these funds, researchers must solicit and integrate external input into the project development. The proposals must also contain a detailed Extension/communication plan describing how the research results will be transferred to the public. All projects are listed on the Rapid Response website (www.rapidresponse.umn.edu) as well as progress and/or final reports.

The Regional Sustainable Development Partnerships, located in five regions around the state, continue to engage the expertise and resources of the University of Minnesota to bring solutions to issues/concerns related to agricultural and natural resources. Researchers from MAES and Extension are members of the regional committees and are involved in collaborative work addressing issues identified by the regional committees.

The College of Agricultural, Food and Environmental Sciences is meeting the stated needs of Minnesota residents by providing outreach programs based on the research work within the college. This includes the issues of food production and safety, biotechnology, yard and garden, community development, and environmental quality. Almost one-half of the faculty have a formal Extension appointment and this provides a thorough

complement of research-based programs that are conducted throughout the state involving all disciplines in the college.

The “Pathways to Educational Partnerships” within COAFES is a statewide, culturally specific community gardening program working with reservation-based Native American communities to establish multiple gardening sites, build horticultural capacities, and restore the physical health of American Indians in Minnesota.

To enhance outreach to the poultry industry, CVM developed a funding strategy with the Minnesota Turkey Growers Association for a new faculty position in pathology/poultry extension and hired an avian pathologist/extension educator.

Reporting requirement for integrated research and extension activities, including Form CSREES – REPT (2/00)

In this accomplishment report, we reported on five joint themes with the University of Minnesota Extension Service. The Hatch and MRF dollars expended for these five themes totaled $544,942.

The actual dollars expended in 2003 for all Hatch projects integrated with Extension (including MRF) are documented on the CSREES – REPT (2/00) form.

As stated in the original Plan of Work, the University of Minnesota has an extensive list of faculty with joint appointments, including both research and extension components, which is attached. This listing provides further evidence of the integrated efforts of federal funding for research and extension.

AREERA
Fiscal Year 2002/2003 EXPENDITURES

Goal / Theme	Hatch	MRF	McIntire Stennis	Animal Health	State Funds	Other Federal	Other NonFederal	Total Funds
Goal 1								
Agricultural Competitiveness	166,707	150,244	0	0	324,026	143,524	175,573	960,074
Animal Health	40,854	35,874	0	0	40,208	0	125,013	241,949
Biotechnology	116,612	0	0	0	250,435	800,405	172,602	1,340,054
Ornamental/Green Agriculture	0	0	0	0	429,713	9,045	156,336	595,094
Plant Health	3,670	65,644	0	0	216,167	242,763	120,912	649,156
Plant Production Efficiency	49,004	0	0	0	328,433	39,408	270,045	686,890
Total Goal 1	**376,847**	**251,762**	**0**	**0**	**1,588,982**	**1,235,145**	**1,020,481**	**4,473,217**
Goal 2								
Food Safety	39,247	1,053	0	0	258,525	21,472	64,181	384,478
Total Goal 2	**39,247**	**1,053**	**0**	**0**	**258,525**	**21,472**	**64,181**	**384,478**
Goal 3								
Human Health	74,020	610	0	0	316,563	124,698	770,712	1,286,603
Total Goal 3	**74,020**	**610**	**0**	**0**	**316,563**	**124,698**	**770,712**	**1,286,603**
Goal 4								
Agricultural Waste Management	40,313	23,744	0	0	25,556	18,964	78,797	187,374
Natural Resources Management	0	0	17,018	0	205,895	458,954	57,156	739,023
Water Quality	36,922	8,631	0	0	73,630	684,369	90,155	893,707
Total Goal 4	**77,235**	**32,375**	**17,018**	**0**	**305,081**	**1,162,287**	**226,108**	**1,820,104**
Goal 5								
Family Resource Management	8,319	0	0	0	51,470	21,119	96,969	177,877
Family Vitality	5,405	0	0	0	77,607	48,079	965	132,056
Total Goal 5	**13,724**	**0**	**0**	**0**	**129,077**	**69,198**	**97,934**	**309,933**
Grand Total	**581,073**	**285,800**	**17,018**	**0**	**2,598,228**	**2,612,800**	**2,179,416**	**8,274,335**

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution University of Minnesota

State Minnesota

Check one
_____Multistate Extension Activities
_____X_____Integrated Activities (Hatch Act Funds)
_____Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	**Actual Expenditures**				
	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Goal 1.	$1,509,210	$3,051,628	$2,109,359	$1,813,789	
Goal 2.	$ 291,982	$ 379,236	$ 137,018	$ 47,235	
Goal 3.	$ 88,621	$ 98,731	$ 52,469	$ 67,215	
Goal 4.	$ 508,025	$ 474,188	$ 340,191	$ 352,567	
Goal 5.	$ 189,992	$ 292,702	$ 180,558	$ 94,161	
Total	$2,587,830	$4,284,038	$2,819,595	$2,374,967	

Form CSREES-REPT (/01)

_____ _____
Director **Date**

Fiscal Year 2002 / 2003 Financial Data

Integrated Research and Extension Activities

University of Minnesota
Agricultural Experiment Station
Minnesota Extension Service

EXTENSION PROGRAM	RESEARCH PROJECT		HATCH $
Goal 1. An Agricultural System That is Highly Competitive in the Global Economy			
Agricultural Risk Management	14-040	ECONOMIC ANALYSIS OF LIVESTOCK INDUSTRY MARKETING, PRICES, PRODUCTION	19,754
	14-046	COMPETITIVENESS AND VALUE-ADDED MARKETS IN THE U.S. GRAIN AND OILSEED	51,661
	14-056	FINANCING AGRICULTURE AND RURAL AMERICA: ISSUES OF POLICY, STRUCTURE AND	18,730
	14-057	AN ECONOMIC ANALYSIS OF U.S. LIVESTOCK SECTOR FACING DEMAND AND SUPPLY	10,169
	14-064	ENVIRONMENTAL AND TRADE COMPETITIVENESS ISSUES IN AGRICULTURE	66,213
	14-160	THE ECONOMICS OF PLANT BIOTECHNOLOGY POLICIES AND PRACTICES:	
Beef Production	03-017	METHODS TO INCREASE REPRODUCTIVE EFFICIENCY IN CATTLE	836
	16-019	INTERPRETING CATTLE GENOMIC DATA: BIOLOGY, APPLICATION, OUTREACH	36,379
	16-044	FACTORS AFFECTING BIOLOGICAL AND ECONOMIC EFFICIENCY OF THE BEEF CATTLE	
	17-056	SOURCES, DISPERSAL AND MANAGEMENT OF STABLE FLIES ON GRAZING BEEF AND	330
	63-036	EVOLVING PATHOGENS, TARGETED SEQUENCES, AND STRATEGIES FOR CONTROL OF	45,141
	63-060	CONTROL OF ANIMAL PARASITES IN SUSTAINABLE AGRICULTURAL SYSTEMS	8,688
Climate and Weather Services	25-064	IMPACT CLIMATE AND SOILS ON CROP SELECTION AND MANAGEMENT	68,716
Commercial Vegetable and Fruit Production	21-027	POSTHARVEST PHYSIOLOGY OF FRUITS	
	21-028	CHANGES IN QUALITY OF HORTICULTURAL CROPS DURING GROWTH AND STORAGE	33,984
	21-049	INCREASING PRODUCTION EFFICIENCY AND LONG TERM HEALTH OF NURSERY	
Commodity Crop Production	01-022	HOST PLANT CONTROL RESISTANCE TO AND BEST MANAGEMENT PRACTICES FOR	1,186
	13-019	OAT BREEDING AND GENETICS	49,004
	13-020	CHARACTERIZING WEED POPULATION VARIABILITY FOR IMPROVED WEED	121,888
	13-022	MOLECULAR CYTOGENETICS IN PLANT IMPROVEMENT	50,399
	13-030	BARLEY BREEDING AND GENETICS	54,026
	13-033	LEGUMES IN CROPPING SYSTEMS	59,051
	13-067	DECISION MAKING FOR DIVERSIFIED CROPPING SYSTEMS	1,476
	17-032	ECOLOGY AND MANAGEMENT OF EUROPEAN CORN BORER AND OTHER	60,981
	17-034	MANAGEMENT STRATEGIES FOR EUROPEAN CORN BORER, CORN ROOTWORMS, AND	13,675
	17-042	POTATO INSECTS: BIOLOGICAL AND CULTURAL CONTROL	18,766
	17-049	MANAGEMENT OF INSECTS AND INSECT VECTORS OF PLANT PATHOGENS	6,158
	21-019	POTATO BREEDING AND GENETICS	
	22-015	COMPARATIVE GENOMICS OF LEGUMES	19,072
	22-020	DISEASE RESISTANCE IN SMALL GRAIN CEREAL CROPS AND THEIR WILD RELATIVES	
	22-026	MANAGEMENT AND CONTROL OF DISEASES OF SOYBEANS	2,939
Dairy Modernization	05-015	MANAGEMENT SYSTEMS TO IMPROVE THE ECONOMICS AND ENVIRONMENTAL	531
	14-055	IMPACTS OF STRUCTURAL CHANGE IN THE DAIRY INDUSTRY	31,556
	16-020	GENETIC SELECTION AND CROSSBREEDING TO ENHANCE REPRODUCTION AND	36,664

EXTENSION PROGRAM	RESEARCH PROJECT		HATCH $
Dairy Modernization	16-027	METABOLIC RELATIONSHIPS IN SUPPLY OF NUTRIENTS FOR LACTATING COWS	65,968
	16-032	STATISTICAL PROCESS CONTROL USE FOR MANAGEMENT DECISION MAKING TO	
Farm Business Management	14-022	ENHANCING THE FINANCIAL VIABILITY OF MINNESOTA FAMILY FARMS	4,515
	14-035	MANAGEMENT INFORMATION SYSTEMS FOR FIRMS IN THE FOOD SYSTEM	50,881
Landscape Design	21-055	BREEDING, EVALUATION & SELECTION OF HARDY LANDSCAPE PLANTS	111,863
Master Gardener	21-050	BREEDING AND GENETICS OF FLORICULTURAL CROPS: OLD, NEW CROP	31,165
	21-064	MOLECULAR ANALYSIS OF FLORAL GENE EXPRESSION	36,665
Nursery and Plant Health	21-073	FREEZE DAMAGE AND PROTECTION OF HORTICULTURAL SPECIES	
	21-082	PLANT AND ROOT RESPONSE TO ENVIRONMENTAL STRESS	32,201
Optimizing Forage Management and Use	13-026	FORAGE PROTEIN CHARACTERIZATION AND UTILIZATION FOR CATTLE	54,700
	17-067	DEVELOPMENT OF PEST MANAGEMENT STRATEGIES FOR FORAGE ALFALFA	14,187
	70-042	ENZYMOLOGY OF FORAGE PROCESSING	4,819
Poultry Production and Health	16-017	ADVANCED TECHNOLOGIES FOR THE GENETIC IMPROVEMENT OF POULTRY	58,133
	16-018	BIOPHYSICAL MODELS FOR POULTRY PRODUCTION SYSTEMS	734
	16-033	WATER QUALITY ISSUES IN POULTRY PRODUCTION AND PROCESSING	
	16-034	IMPROVING TURKEY PRODUCTION PERFORMANCE THROUGH NUTRITION AND	108,556
	16-087	REPRODUCTIVE PERFORMANCE OF TURKEYS	238,811
	63-032	AVIAN RESPIRATORY DISEASES: PATHOGENESIS, SURVEILLANCE, DIAGNOSIS AND	549
Precision Agriculture	12-028	DEVELOPMENT AND TESTING OF DRY FERTILIZER SENSORS AND MACHINERY FOR	2,218
Swine Production Technology	16-025	GENETIC AND FUNCTIONAL GENOMIC APPROACHES TO IMPROVE PRODUCTION AND	1,787
	16-064	EVALUATION OF NEW NUTRITIONAL TECHNOLOGIES FOR SITUATION DEPENDENT	20,854
	60-015	PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME (PRRS): MECHANISMS OF	55,874
Turf Management	21-054	THE BIOLOGY AND UTILIZATION OF TURFGRASSES	31,336
	Total Hatch Dollars - Goal 1.		**$ 1,813,789**
Goal 2. A Safe and Secure Food and			
Food Safety	12-020	MANAGEMENT OF GRAIN QUALITY AND SECURITY FOR WORLD MARKETS	2,460
	18-023	FUNCTIONAL FOODS: FIBER-AND ANTIOXIDANT-ENRICHED FOODS	
	18-037	CHARACTERIZATION AND CONTROL OF THE ACID RESISTANCE OF	18,553
	18-039	ENHANCING FOOD SAFETY THROUGH CONTROL OF FOOD-BORNE DISEASE AGENTS	
	18-054	ELIMINATION OF ESCHERICHIA COLI AND SALMONELLAE FROM READY TO CONSUME	2
	18-072	PROCESSING AND STORAGE EFFECTS ON STABILITY OF NUTRACEUTICALS	17,640
	18-074	APPLICATION OF CHEMILUMINESCENT ANTIBIOTICS AS PLATFORM TECHNOLOGY	6,694
	22-043	MYCOTOXINS IN CEREAL GRAINS	1,886
	Total Hatch Dollars - Goal 2.		**$ 47,235**
Goal 3. A Healthy, Well-Nourished Population			
Building Healthy Communities	18-055	ANALYSIS OF BACTERIOPHAGE RESISTANCE AND BACTERIOCIN PRODUCTION OF	18,858
	54-026	IDENTIFICATION OF FACTORS PREDICTING CONSUMPTION OF SELECTED DIETARY	24,400
	54-028	PARENT AND HOUSEHOLD INFLUENCES ON CALCIUM INTAKE AMONG	610
	54-030	SYSTEMS ANALYSES OF THE RELATIONSHIPS OF AGRICULTURE AND FOOD SYSTEMS	1,047

EXTENSION PROGRAM	RESEARCH PROJECT		HATCH $
Building Healthy Communities	54-034	DIETARY REGULATION OF SEX HORMONE SYNTHESIS AND METABOLISM	
	54-048	QUANTIFICATION OF FATTY ACID AND TRIGLYCERIDE FLUX IN FASTED AND FED	
	54-059	A MULTICULTURAL INVESTIGATION OF FOOD AS MEDICINE	
Healthful Whole Grains Learning Circle	18-066	STRUCTURE/FUNCTION RELATIONSHIPS IN WHOLE GRAINS AND THEIR INFLUENCE ON	10,396
	54-064	DEFINING A DESIRABLE DIETARY FIBER INTAKE	11,904
Nutrition Education for Limited Resources Families	54-029	EXAMINATION OF NUTRITIONAL STATUS AND DIETARY BEHAVIOR FOR MINORITY	
	Total Hatch Dollars - Goal 3.		**$ 67,215**

Goal 4. An Agricultural System Which Protects Natural Resources and the Environment

Best Management Practices for Environmental Field	25-084	IMPROVING PLANT NUTRIENT USE EFFICIENCY	2,562
Drainage Education and Water Management	12-040	INVESTIGATING DRAINAGE DESIGN AND MANAGEMENT ALTERNATIVES FOR MEETING	18,042
	14-029	DECISION MAKING FOR AGRICULTURAL FIRMS CONSIDERING RISK AND THE	318
	25-020	SOIL RESOURCE ASSESSMENT AND INTERPRETATIONS FOR MINNESOTA LANDSCAPES	13,434
	25-022	ASSESSING NITROGEN MINERALIZATION AND OTHER DIAGNOSTIC CRITERIA TO	530
	25-034	TILLAGE AND NUTRIENT SOURCE INTERACTIONS ON NON-POINT SOURCE	2,000
	25-035	MANAGEMENT OF ERODED SOILS FOR ENHANCEMENT OF PRODUCTIVITY AND	944
	25-083	BIOGEOCHEMISTRY AND ECOLOGICAL RISK MANAGEMENT OF TRACE CHEMICAL	10,285
	42-037	REMOTE SENSING OF LAND, VEGETATION, AND WATER RESOURCES	36,922
Environmental Science Education Workshops	14-073	U.S. AGRICULTURAL AND ENVIRONMENTAL POLICY	50,379
	14-089	EXAMINING POLICIES AND INSTITUTIONS FOR LAND AND WATER RESOURCE	55,452
	41-033	EVOLUTIONARY GAMES AND MODELING CONSERVATION: CONSEQUENCES OF SPACE	
	41-074	TROPHIC RELATIONS IN FRESHWATER SYSTEMS	
	41-086	RELATIONSHIPS BETWEEN WILD UNGULATES & NATURAL VEGETATION:	13,759
Improving the Competitiveness of Minnesota's Wood	22-069	BIOLOGY, CONTROL, AND BIOTECHNOLOGICAL USES OF FOREST MICROBES	51,939
	43-054	ASSESSMENT OF CHANGING RAW MATERIAL NEEDS AND LIFE CYCLE	
Manure Management Education	12-084	ANIMAL MANURE AND WASTE UTILIZATION, TREATMENT AND NUISANCE	64,057
Non-Timber Forest Products Development	43-068	LIGNIN BIOSYNTHESIS, BIODEGRADATION AND DERIVATIVE PLASTICS	18,622
Pesticide Safety Education	25-019	REDUCING THE POTENTIAL FOR ENVIRONMENTAL CONTAMINATION BY PESTICIDES	8,631
Residential Building	53-065	DEVELOPMENT OF AN INTERIOR MATERIAL RATING SYSTEM FOR ENVIRONMENTAL	4,691
Waste and By-Product Management	12-076	ENVIRONMENTAL AND AIR QUALITY ASSESSMENT AND CONTROL OF LIVESTOCK	
	Total Hatch Dollars - Goal 4.		**$ 352,567**

Goal 5. Enhanced Economic Opportunity and Quality of Life

Adult Children and Aging Parents	52-040	FAMILY SYSTEMS AND FAMILY REALITIES	1,995
	52-049	FAMILY BOUNDARY AMBIGUITY IN ALZHEIMER'S DISEASE AND OTHER SITUATIONS	1,284
	52-054	DECISION-MAKING INTEGRAL TO RELATIONSHIP TRANSITIONS IN FAMILIES	5,359
	55-035	VITAL INVOLVEMENT PRACTICE: PROMOTING LIFE STRENGTHS AMONG DIVERSE	8,048
Agricultural Workplace Safety and Health	12-027	INJURY PREVENTION AND HEALTH PROMOTION RESEARCH FOR PRODUCTION	17,624
Civic Connections	42-046	BENEFITS-BASED MANAGEMENT: ASSESSING AND MANAGING FOR PUBLIC, PRIVATE,	12,520
Community Economic Analysis	13-015	SUSTAINING LOCAL FOOD SYSTEMS IN A GLOBALIZING ENVIRONMENT, FORCES,	649
	14-082	RURAL COMMUNITIES, RURAL LABOR MARKETS, AND PUBLIC POLICY	6,290

EXTENSION PROGRAM	RESEARCH PROJECT		HATCH $
Community Economic Analysis	14-094	RURAL LABOR MARKET BEHAVIOR AND OUTCOMES: THE ROLE OF WORK SUPPORT	107
	52-077	SELF EMPLOYMENT AMONG THE UNITED STATES HISPANIC HOUSEHOLDERS	3,485
Dollar Works	52-055	FAMILY ECONOMIC WELL-BEING: TRANSITIONS FOR FAMILIES	7,125
	52-080	ASSET ACCUMULATION FOR LOW-INCOME WORKING FAMILIES	3,300
Home Stretch	53-073	HOUSING, NEIGHBORHOOD, AND COMMUNITY ENVIRONMENTS OF LOW-RESOURCE	540
Minnesota Rural Health Works	52-078	RURAL LOW-INCOME FAMILIES: TRACKING WELL-BEING AND FUNCTIONING IN THE	1,168
Positive Parenting	55-036	SOCIAL SUPPORT, SOCIAL NETWORKS, AND FAMILY VIOLENCE	6,228
Take the Road to Financial Security	52-073	FAMILY BUSINESS: WORK AND FAMILY INTEGRATION	5,019
Teen Talk Learning Circles	55-048	PATTERNS OF ADAPTATION AND ACCEPTANCE OF HISPANICS IN AMERICAN	9,299
The Growing Season	52-066	INTERGENERATIONAL RELATIONSHIPS IN SOUTHEAST ASIAN REFUGEE FAMILIES	4,121
	Total Hatch Dollars - Goal 5.		**$ 94,161**
	Total Hatch Dollars - All Goals		**$2,374,967**

FY 2003 Faculty with Joint Appointments (Research/Extension)

College / Department	Research	Extension	Teaching	Total
COAFES				
NWROC - Crookston				
Marx,George Donald	82%	18%	0%	100%
Hollingsworth,Charla R	70%	30%	0%	100%
Macrae,Ian Vance	51%	49%	0%	100%
Wiersma,Jochum Jan	52%	48%	0%	100%
WCROC - Morris				
Johnston,Lee Jay	80%	20%	0%	100%
Rudstrom,Margaretha V	67%	33%	0%	100%
NCROC - Grand Rapids				
Lamb,Graham Clifford	77%	23%	0%	100%
SROC - Waseca				
Fritz,Vincent A	70%	30%	0%	100%
Baidoo,Samuel Kofi	80%	20%	0%	100%
Zhu,Jun	80%	20%	0%	100%
BioSystems & Ag Engineering				
Jacobson,Larry Dean	25%	75%	0%	100%
Janni,Kevin A	45%	35%	20%	100%
Morey,R Vance	35%	35%	30%	100%
Wilcke,William F	25%	75%	0%	100%
Shutske,John M	25%	75%	0%	100%
Sands, Gary R	35%	65%	0%	100%
Agronomy & Plant Genetics				
Becker,Roger Lee	25%	75%	0%	100%
Durgan,Beverly R	26%	71%	3%	100%
Gunsolus,Jeffrey L	30%	70%	0%	100%
Hicks,Dale Ray	8%	92%	0%	100%
Naeve,Seth	25%	75%	0%	100%
Peterson,Paul	25%	75%	0%	100%
Applied Economics				
Olson,Kent D	35%	25%	40%	100%
Parliament,Claudia	15%	49%	36%	100%
Open Position	37%	54%	9%	100%
Buhr,Brian L	40%	40%	20%	100%
Fruin,Jeremiah E	50%	50%	0%	100%
Lazarus,William Frankl	20%	80%	0%	100%
Stinson,Thomas F	47%	44%	9%	100%
Taff,Steven James	25%	75%	0%	100%
Hurley,Terrance M	35%	56%	9%	100%
Kalambokidis,Laura TJachim	30%	70%	0%	100%
Animal Science				
Linn,James Gary	15%	75%	10%	100%

Noll,Sally	15%	75%	10%	100%
Seykora,Anthonly	5%	17%	78%	100%
Shurson,Gerald C	5%	30%	65%	100%
Dicostanzo,Alfredo	19%	71%	10%	100%
Endres,Marcia Ines	25%	75%	0%	100%
Entomology				
Hutchison,William Dale	60%	40%	0%	100%
Ostlie,Kenneth R	40%	60%	0%	100%
Ragsdale,David Willard	59%	15%	26%	100%
Krischik,Vera	28%	72%	0%	100%
Spivak,Marla S	57%	14%	29%	100%
Cannon, Colleen	40%	60%	0%	100%
Food Science & Nutrition				
Addis,Paul B	40%	15%	45%	100%
Feirtag,Joellen	3	94	3	100
William Schafer	2	95	3	100
Horticultural Science				
Hoover,Emily Esther	17%	24%	59%	100%
Rosen,Carl Jay	16%	81%	3%	100%
Erwin,John E	55%	45%	0%	100%
Meyer,Mary H	15%	85%	0%	100%
Tong,Cindy BS	41%	59%	0%	100%
Horgan, Brian	40%	60%	0%	100%
Plant Pathology				
Jones,Roger Kent	20%	80%	0%	100%
Powell,Jon F	69%	31%	0%	100%
Soil, Water & Climate				
Anderson,James L	1%	88%	11%	100%
Lamb,John Alexander	55%	20%	25%	100%
Moncrief,John F	12%	88%	0%	100%
Rehm,George W	18%	79%	3%	100%
Robert,Pierre C	50%	30%	20%	100%
Rosen,Carl Jay	24%	57%	19%	100%
Schmitt,Michael A	20%	80%	0%	100%
Seeley,Mark W	21%	79%	0%	100%
CHE				
Family Social Science				
Bauer,Jean W	35%	51%	14%	100%
Danes,Sharon M	40%	60%	0%	100%
Stum,Marlene Sue	30%	70%	0%	100%
Design, Housing & Apparel				
Bruin,Marilyn J	40%	60%	0%	100%
Food Science & Nutrition				
Hassel,Craig Alan	29%	64%	7%	100%
Reicks,Marla M	23%	69%	8%	100%

CNR				
Fisheries & Wildlife				
Perry II,James A	62%	5%	33%	100%
Oberhauser,Karen	10%	35%	55%	100%
Blair,Bob	11%	69%	20%	100%
Forest Resources				
Blinn,Charles Robert	27%	69%	4%	100%
Ek,Alan Ryan	47%	9%	44%	100%
Wood & Paper Science				
Massey,Joseph	96%	1%	3%	100%
Ramaswamy,Sridharan	75%	5%	20%	100%
VET Med				
Clinical & Population Sciences				
Ames,Trevor R	29%	9%	62%	100%
Fetrow,John P	32%	52%	16%	100%
Dee,Scott Allen	64%	27%	9%	100%
Veterinary Pathobiology				
Halvorson,David A	42%	48%	10%	100%