Annual Report
of
Accomplishments and Results

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

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Table of Contents

Executive Summary

This report of research progress for 2002 summarizes MAES research on several fronts. Eight key AES research themes are highlighted, and five key themes are reported jointly with the University of Minnesota Extension Service. Reviewers of last year's report suggested it would be useful to file a complete joint report. As we originally filed separate Plans of Work, and federal reporting requirements state that we must report according to our Plan of Work, that is not possible. Therefore, note that the joint Extension/Research reports for five key themes: *Risk Management, Human Health, Forest Resource Management, Multicultural and Diversity Issues, and Farm Safety*, are identical in both the MAES and Minnesota Extension reports. Further information on the projects reported here can be found in *Minnesota Impacts*, a Web-based public accountability database of both the Minnesota Agricultural Experiment Station and the University of Minnesota Extension Service. Its URL is: www.extension.umn.edu/mnimpacts

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.)**

Research progress reported this year focuses on several significant areas, including groundbreaking work in understanding the molecular basis of rust resistance in cereal and has successfully transformed a susceptible barley variety through genetic engineering. U of M researchers have also completed sequencing of the genome of the bacteria that causes Johne's disease, a major wasting disease found in dairy cattle. This will allow researchers to develop new ways of early diagnosis, prevention and treatment of a disease that costs the dairy industry more than $200 million a year. Another major breakthrough in animal health research is the development of a vaccine for avian pneumovirus developed by the University of Minnesota that has recently been approved by the USDA for sale in the Midwest. This disease has spread throughout the turkey-producing areas of Minnesota, causing about $15 million a year in production losses.

The development of web-based technology is being exploited by MAES researchers in several ways to bring the research of the University to the agricultural industry. This report discusses the value of the Minnesota Agricultural Transportation Database, the Minnesota Climate and Soils database, Aphid Alert, and others. Through these databases, growers and producers receive both historical data and real time information to guide their business decision-making.

In previous years' reports we have discussed the impact of MAES research on the state's ornamental horticultural industry, describing the value of fruit and flower variety developments. This year we note the importance of turf variety research to the state's turf industry.

***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.)**

Progress in research into the control of food borne illnesses is focused on several aspects of the food industry, especially the issues raised by the growing organic food industry, as well as protection against Salmonella and E. coli infection of meat, fresh, and minimally processed foods. In collaboration with a Wisconsin state lab, researchers have had success testing for generic strains of both Salmonella and E. coli.

***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 on research into aspects of human health is reported jointly with the University of Minnesota Extension Service, as the role of transmission of research findings through the Extension network is particularly useful with this work. Although some of the human health research reported this year is basic research, it informs the broader understanding of health issues for Extension education. Researchers have made progress in understanding the anti-cancer potential of such foods as soy and flax seed, and finding strategies to increase fruit and vegetable consumption in a variety of consumer groups.

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

Results of research into dairy grazing systems are reported under the theme *Agricultural Profitability.* However, research into pasture-based livestock production systems also has water quality implications. Also discussed under Goal 4 is progress on continuing work on several fronts to reduce the Mississippi River nitrate levels, which are three times higher now than in the 1950s. Other research in drainage, and forest resource management, is also highlighted.

***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.)**

In previous years' reports, important progress in family social science research has been the focus. This year the key theme *Multicultural and Diversity Issues* was selected to illustrate the growing base of knowledge and impacts in this area as a result of MAES research. As the population of Minnesota becomes increasingly diverse, this has created challenges to our social systems, and raised important issues such as minority population's access and use of health care. At the same time, a traditional rural audience still requires attention, and so we also focus in this report on progress in farm safety.

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In many cases, the research reported here has been augmented by and has leveraged other sources of funding, including state, local and grant funding. A significant source of funding has been the Rapid Agricultural Response Fund, which comes to MAES from special appropriations of the Minnesota State Legislature.

Key Theme: Risk Management (JOINT)

MAES Plan of Work: GOAL 1: Program 1, Agricultural Production and Farm Business Management; Program 2, Agricultural Marketing and Distribution; Program 9, Crop Production and Management Strategies; Program 13, Agricultural Information Technology

Extension Plan of Work: GOAL 1, Agriculture, Food, and Environment Capacity Area: Agricultural Financial Risk Management, Agricultural Marketing, Processing, and Distribution—Market Outlook and Marketing Clubs, Post-Harvest Marketing, pre-Harvest Marketing Plan, and Winning the Game Programs

a. Description

Research: A study analyzing the returns to scale and diversification for local farm supply and grain-marketing cooperatives was completed using data from 377 local supply and grain marketing cooperatives in five Upper Midwestern states. Those achieving the lowest cost were assigned an efficiency of 1.0, while those with higher costs were given an efficiency of less than 1.0. For example, an efficiency of 0.7 indicates the firm had costs 30 percent higher than the most efficient firms. Overall efficiency averaged 0.67 for grain cooperatives, 0.72 for grain/supply cooperatives, 0.70 for supply cooperatives, and 0.67 for petroleum cooperatives. These overall efficiencies indicate that costs averaged 33 percent above the minimum. Analysis showed that inefficiencies in labor and capital use within the business are the major reason costs are above the minimum achieved by some firms. The study also revealed that diversification may be an effective risk management strategy for many cooperatives.

Other research indicated that producer savings accounts are likely to be of limited assistance in risk management for all but the highest income farms.

Producers need up-to-the-minute data on pricing to make the best decisions on forward pricing the commodities they raise. A new decision model takes advantage of the internet as a powerful medium for providing real-time knowledge in a highly cost effective manner. The real-time decision model relies on continuously changing information, which can only be done using web-based technologies. During the first year of funding of this program a successful portal website was created and nine marketing decision tool modules were created.

To further support producers in risk management, a Marketeer software program has been developed and has been used extensively during the past two years by producers, educators, and market advisors. New components that have been incorporated into the software include a tracking system that allows the producers to enter actual prices received and compare to their marketing plan; expansion beyond grains to include marketing plans for dairy; research data and an educational program that use historical and seasonal comparisons to help producers develop their marketing plans; development of a 'what if' component that allows producers to explore the impact of different marketing strategies; and the incorporation of crop insurance strategies in combination with the marketing plan. There are 510 licensed copies of Marketeer in the hands of 344 agricultural professionals and 166 producers. Professional users in turn work with up to 100 producers, expanding the impact of Marketeer to several thousand of producers. Subsequent training programs for producers have used Marketeer software and concepts to help producers develop market plans, include price seasonality more effectively in their plans, better understand how to incorporate crop insurance into their marketing plans, and practice implementing their plans.

Extension: The Center for Farm Financial Management (CFFM) in the Applied Economics Department at the University of Minnesota develops and distributes FINPACK and other agricultural financial software and provides training for agricultural educators and other agricultural professionals in the use of these tools to help farmers efficiently and effectively manage their businesses. They learn how to evaluate their profitability, how to calculate production costs, how to develop sound strategic financial plans, and how to project reliable cash flow plans. An estimated 30,000 producers are assisted with financial planning each year nationally; 10,000 of them in Minnesota. In addition, CFFM has been highly instrumental in the development and maintenance of the National Agricultural Risk Library and FINBIN, the financial database that provides essential information for estimating costs and returns for various crops and livestock enterprises.

The purpose of the Post-Harvesting Marketing Program is to teach producers post-harvest marketing techniques and to encourage them to develop and implement a post-harvest marketing plan for their grain. Participants learn about basis, futures prices, storage carry, storage hedging, and developing a marketing exit strategy. They then develop and implement a post-harvest marketing plan for their farm business. A simulation game enables them to see what the financial impact would be on their business if they implement their plan. Participants paid a fee of $75 for this program.

The Winning the Game Program focuses on pre-harvest planning for marketing, including using crop insurance to reduce risk. It also utilizes a simulation game to show producers the financial impact of planning ahead and implementing their marketing plans. The Winning the Game Program has been very successful in involving local banks, grain elevators, and other agribusinesses in co-sponsoring the program--providing financial support and encouraging their customers to participate. The Minnesota Soybean Research and Promotion Council provided a grant of $15,000. Participants paid a fee of $420 for Winning the Game.

b. Impact

Research: The web-based decision modules have been a tremendous benefit to farmers and lenders in making financial planning decisions. The marginal cost of delivering this real time information to a potentially infinite set of users is nearly zero. Marginal cost is the cost of adding one additional user. The value on this scale can be enormous even if the marginal cost is only a few dollars per head for any given producer.

Training sessions for producers using the Marketeer software have been attended by more than 7,000 producers throughout much of the Midwest and West. Professional users of Marketeer have worked with another 2,000 producers individually to develop and implement marketing plans. Conservative estimates indicate that producers who have implemented their marketing plans add at least $.15 per bushel to the price they receive for grain. For the typical 600-acre southern Minnesota producer, this would add $9,000 to their gross returns each year.

Extension: Forty-one producers in southern Minnesota participated in the Post Harvest Marketing Program in 2002. All of them developed a marketing plan for their grain. More than 2,300 producers participated in Winning the Game.

Educators estimate that participants in the Post-Harvest Marketing Program earned an additional $2,380, on average, by implementing their marketing plans. The overall economic impact for the 41 participants could be as much as $97,580 for 2002. The direct costs of delivering the program (out of pocket costs, excluding the value of the educator's time) were estimated at $592. Participant fees paid totaled $3,075.

Nearly 15 percent of the Winning the Game Program participants began using revenue-based crop insurance after learning about this in the program. Adding them to the number of participants that were already using revenue-based crop insurance brought the total number insured in the group to over 87 percent. Educators estimated that program participants could earn an additional 19 cents a bushel for corn, 33 cents a bushel for soybeans, and 14 cents a bushel for wheat, based on historical average prices, by implementing what they were taught in the program. A follow-up survey indicated that producers earned an additional $3,888, on average, from pre-harvest marketing planning. The total economic impact for program participants is estimated to be over $7.2 million for 2002 crops.

c. Source of Federal Funding: Hatch and Smith-Lever 3b&c

d. Scope of Impact: Multi-State

Key Theme: Biotechnology (RESEARCH)

MAES Plan of Work: GOAL 1: Program 7, Understanding Physiological Processes Impacting Production and Quality Traits in Cropping Systems; Program 8, Genetic Enhancement in Plant Production Systems; Program 13, Agricultural Information Technology

a. Description

University of Minnesota researchers have achieved a major breakthrough in the goal to understand the molecular basis of rust resistance in cereal. The current scab epidemic, which began in 1993 has cost wheat and barley growers approximately $2 billion since it started. Much of the pioneering work on breeding for rust resistance in cereals was initiated at the U of M in the early 1920s. However rust pathogens were capable of change and new races arose that could overcome the plant's resistance. Research then focused on more durable sources of resistance—those that could remain effective for a long time against a variable pathogen population. Researchers at the U recently cloned and sequenced the stem rust resistance gene Rpg1 from barley. This is the first rust resistance gene isolated from a small grain cereal crop. The function of the cloned Rpg1 gene has been demonstrated by genetic engineering of susceptible cultivars. The function of this cloned Rpg1 gene was unequivocally demonstrated by transforming the stem rust susceptible cultivar Golden Promise into a resistant one. In fact, one of the most remarkable aspects about the Golden Promise transformants is that they exhibited a higher level of resistance than the original source of the gene. This finding is very significant because it suggests that cloned resistance genes may provide enhanced resistance when they are transferred into different genetic backgrounds.

The genetic structure of *Fusarium graminearum* (also known as scab) is not well understood, and only a rudimentary genetic map currently exists. It is believed to have between 7,000 and 10,000 genes. It is on a national list of fungal organisms that cereal researchers consider of high-priority need for full genome sequencing. With special state funding by the Rapid Agricultural Response Fund, researchers are developing a genetic map of the *Fusarium gaminearum* genome. To extend the research, they have developed, in collaboration with other researchers, a web accessible database for access by the fungal genetics community.

A severe 1999 epidemic of leaf rust on wheat caused a yield reduction of 3.5 million bushels in Minnesota and 7 million in North Dakota. It was largely caused by eroding effectiveness of leaf rust resistance genes in regionally grown spring wheat varieties. Researchers have been working on the enhancement of leaf rust resistance in spring wheat and have derived wheat lines with leaf rust resistance genes. These lines are now being used as recurrent parents in the Minnesota wheat improvement project. These parental lines are a major step forward for improvement of leaf rust resistance in spring wheats adapted for Minnesota. These parental lines will be used

in crosses with lines that have improved resistance to Fusarium head blight in order to develop wheat cultivars with resistance to both diseases.

Research into the genomic of cyst nematode resistance in soybean has also shown results. One of the most immediate applications of researchers genomic analysis of SCN resistance has been the development of DNA marketers suitable for use in marker-assisted selection. As a result of this works, several Minnesota-adapted genotypes have been tested as part of regional variety trials. These lines are part of continuing effort to introduce new sources of SCN resistance into short maturity group soybeans.

University of Minnesota researchers, with collaborators at the U.S. Department of Agriculture's National Animal Disease center in Ames, IA, have completed sequencing the genome of the bacteria that causes Johne's disease, a major chronic wasting disease found in dairy cattle. The bacterium, *Mycobacterium paratuberculosis*, is considered one of the most important threats to the health of dairy cattle worldwide, and may represent a potential risk to safety of the milk supply. The gene sequencing will allow researchers to develop new ways of early diagnosis, prevention and treatment of a disease that costs the dairy industry more than $200 million a year.

The slow-growing nature of the bacterium has been an impediment to the diagnosis of infected animals and also has served as a major obstacle for laboratory-based research on the pathogen. The sequencing project represents part of an ambitious "microbial pathogenomics" research program at the University of Minnesota to sequence the genomes of a wide range of human and animal pathogens and use this information as a basis to understand the mechanisms by which they cause disease.

b. Impact

One of the most significant aspects about the successful transformation of the susceptible barley variety though genetic engineering is that it conferred immunity or near-immunity to the rust pathogen, a level of resistance that was higher than the original source of the resistance gene. Research is underway to determine whether the Rpg1 gene might also function in wheat.

One of the most important diseases of soybean is the cyst nematode. In recent years it became clear that one gene, Rhg1, is especially important in resistance. Researchers have characterized this gene, pinpointed its location of the soybean map and developed tools to isolate it by positional cloning. In the process, they have identified resistance genes elsewhere in the soybean genome, developed DNA markers suitable for marker-assisted breeding, and developed a broad range of genome tools for use in soybean and other legume crops.

Genetic evaluations for somatic cells scores in milk (that serve as an indicator for mastitis) have already had a meaningful impact on the profitability of Minnesota

dairy farms. These farms have already started to witness a decline in transmission of somatic cells from generation o generation. Germplasm of dairy cattle with improve disease resistance will be available to all dairy producers who use frozen semen from commercial breeding organizations. Over 60 percent of Minnesota dairy producers receive their germplasm from these sources.

The genes researchers have identified in the bacteria that causes Johne's disease will serve as targets for the development of new generations of diagnostic tests that are critically needed for the detection and ultimate eradication of the disease. Recognizing the importance of the disease and the devastating impact on dairy production, the U.S. House Agriculture Appropriations Subcommittee recently approved $20,352,000 for the National Johne's Disease Management and Testing Program for the current fiscal year.

c. Source of Federal Funding: Hatch

d. Scope of Impact: Multi-State

Key Theme: Animal Health (RESEARCH)

MAES Plan of Work: GOAL 1: Program 4, Physiological Processes Impacting Production and QualityTraits in Agriculture Animals; Program 5, Animal Production and Management Strategies; Program 6, Genetic Enhancements in Animal Systems

a. Description

Avian pneumovirus (APV) is a respiratory disease that University scientists first identified in 1997. The disease has spread throughout the turkey-producing areas of Minnesota, causing roughly $15 million a year in production losses. Due to the immunosuppressive nature of the virus and subsequent bacterial infections, up to a fourth of the flock may die. For Minnesota, the nation's leader in turkey production and processing, one of the greatest potential risks of the disease could be the increased condemnation of birds and a ban of Minnesota birds for foreign markets. Emergency funding was first appropriated by the State Legislature in 1998, and since then U of M researchers have conducted over $1 million worth of research. Additional funding through a grant from the U.S. Department of Agriculture is aimed at developing more disease-resistant birds for breeding. The investment has led to dramatic results. Researchers have:

- Developed diagnostic tests to rapidly identify infected flocks
- Determined how the disease is spread, and developed containment procedures, and
- Developed a vaccine that protects against APV.

The results of the study are published in the August 2002 issue of *Avian Pathology*.

All food animal industries, including dairy, are under increasing pressure to address routine use of drugs in livestock management. Public health officials and the public express growing concern about the potential for promoting the evolution of resistant pathogens through the routine use of antibiotics with food animals. Minnesota's dairy industry has needed to develop and implement a rational and scientifically justifiable basis for drug use in dairy cows. U of M researchers have been developing a series of policies, protocols, and specific prescription writing software, to govern and guide implementation of a "best practices" model for drug use on dairy farms. This project, in cooperation with the Minnesota Board of Veterinary Medicine and the Minnesota Veterinary Medical Association has:

- Worked with the industry to identify areas most needing solutions.
- Drafted policies defining the proper veterinary role in prescribing and using drugs on dairy farms.
- Created a limited access web site for implementation discussion within the profession.
- Developed protocols for therapeutic and production uses of drugs on dairies.
- Produced prototype drug information sheets for approved dairy pharmaceuticals.
- Identified veterinary practices willing to field test the program's implementation.

Curtain-sided naturally ventilated freestall dairy barns are commonly used throughout the upper Midwest and Minnesota; however, environmental conditions in these barns are not well documented. Livestock facilities generate contaminants that can become airborne at sufficient concentrations that are deemed to be harmful to people, animals and the environment, or unacceptable by people exposed. Researchers measured temperatures and relative humidity levels in representative naturally ventilated curtain-sided freestall dairy barns. The cold weather results indicate that most barns have higher than recommended relative humidity levels during much of the cold weather season. Hot weather temperature-humidity index results indicate that these barns were in the mild stress level between 10-to-12 percent of the time during the hottest week. Numerous biofilter studies were conducted in conjunction with this project. The research has documented that well run and maintained units can remove 90 percent or more odor and hydrogen sulfide. Ammonia removal ranged from 50-to-90 percent.

Through much of the past decade, the U.S. and global swine industries have experienced major economic loses from Porcine Reproductive and Respiratory Syndrome Virus (PRSV). 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. Even herds that had been considered purged of the disease have experienced recurrent outbreaks. 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. The "test and remove" method has been used successfully to eradicate the disease on a farm-by-farm basis, but other Minnesota research is taking a pathobiological approach to combat PRRSV. This

research is being conducted simultaneously with other AES research focusing on practical management and epidemiological avenues to deal with the disease. Researchers have identified two of the genes that are affected by PRRSV and placed them on the gene map. The work may identify mechanisms for boosting host immunity against the virus or for drug treatment to clear the virus from infected herds.

b. Impact

The vaccine for avian pneumovirus has recently been approved by the USDA for sale in the Midwest. The vaccine is now available to turkey growers in Minnesota, the largest turkey producing state in the country, as well as North Dakota, South Dakota, Wisconsin, and Iowa.

Results of the environmental assessment of curtain-stall dairy barns have led to the development of biofilter design and operation guidelines that deal with media selection, biofilter design and sizing, moisture control and maintenance. These guidelines help builders and producers design, build, and manage these barns to economically provide a healthy environment all year round.

c. Source of Federal Funding: Hatch

d. Scope of Impact: Multi-State

Key Theme: Ornamental/Green Agriculture (RESEARCH)

MAES Plan of Work: GOAL 1: Program 11, Green Industry

a. Description

On a wholesale value, the Minnesota floriculture greenhouse industry has grown at a rate of 7-to-17 percent per year between 1990 and 2000. Minnesota is now the largest floriculture greenhouse crop producer in the upper Midwest. Research to reduce production costs in the Minnesota greenhouse industry, which consists of more than 1,000 family owned businesses, has recently been focused on how to control flowering of traditional and new greenhouse crops. Researchers have identified how day length and light intensity affect flowering of more than 60 spring greenhouse crop species. The species were grown in greenhouses under eight different environments varying in day length and light intensity. The results will allow growers to schedule flowering, reduce production costs and/or produce more product out of the same facility during a given time. Current work also involves identifying new floriculture crops that grow well in Minnesota with reduced inputs.

Researchers are conducting a series of research and demonstrations projects to develop Integrated Pest Management practices and pesticide reduction recommendations for fungus gnats, a group of serious pests commonly found in commercial greenhouses. Research has confirmed that the potato disk monitoring technique, commonly used by greenhouse growers, is an effective tool for early detection of fungus gnat infestations. Investigations have also confirmed the efficacy of entomopathogenic nematodes, a biological control agent, to control fungus gnat in greenhouse crops.

Researchers have been looking at different fertilizers and irrigation methods in the hope of taking at least a year off of growing time for certain plants. By accomplishing these objectives, Minnesota's nursery industry can grow plants more efficiently and impact the environment as little as possible.

Data collected on silicon additions to roses showed that these additions have a positive effect on the resistance of rose to blackspot. Additional experiments on lilacs and powdery mildew also showed that increasing the availability of silicon to plants increases their disease resistance.

Northern Minnesota turf grass seed production contributes millions of dollars to the region's economy. However, the industry is in crisis due to the loss of market share for varieties currently in production. Park Kentucky bluegrass released by the U of M in 1957, the basis of Minnesota's seed industry, has dramatically lost market share due to poor disease resistance. Researchers developed a system using tissue culture to create mutations that generate potential new varieties. Two large-scale seed increases of tissue culture derived Kentucky bluegrass lines were established in 2001. Sustainable and environmentally friendly alternatives to intensive, high maintenance turf management are in high demand. One of the most significant ways to address these issues is through the development of new varieties of turf grasses that possess improved characteristics such as multiple pest resistance, winter hardiness, efficient water and nutrient use, and high levels of stress tolerance. In 2002, seed was harvested from approximately 75 lines and seeded into turf trials.

b. Impact

The results of research on controlling stem elongation and flowering are being used by greenhouses around the world.

Decreasing spring floriculture crop time by about 25 percent means an increase in profit of at least 20 percent annually as another crop can be produced in the spring. Research has also helped to dramatically increase predictability in flowering, which improves the quality and marketability of ornamental products. Individual greenhouses have already applied the research results. For example, one greenhouse that exports more than 150 million seedlings annually has cut production time needed to produce seedlings for exports. By reducing crop times dramatically and by increasing the number of crops produced in a given facility, there is a decrease in

production costs and inputs. For instance, reducing crop time decreases fertilizer application and run off, and also decreases heating and electrical costs. In addition, both pesticide and fungicide application levels can be reduced.

In 2001, Minnesota commercial floriculture businesses spent an estimated $3.7 million on pest management. Reduced pesticide applications will reduce the cost of goods sold for consumers and improve gross margins for producers.

Information provided to nursery growers have allowed them to reduce phosphorous inputs, save money and help the environment. Work on the use of sodium silicate can significantly reduce fungicide costs to producers.

The northern Minnesota seed production industry has become economically viable through research conducted at the U of M. The demand for high quality turf seed has increased dramatically during the last 30 years. Minnesota produced seed has several advantages over seed produced in Washington and Oregon, the primary seed-producing region in the U.S. The seed is consistently of high quality and free of annual bluegrass seed, a noxious weed in the turf and sod industry. High quality seed production continues to be a factor in maintaining a healthy economy in northern Minnesota. The projected economic impact of seed production of new varieties of Kentucky bluegrass is $3.5 to $4.5 million dollars annually.

c. Source of Federal Funding:

d. Scope of Impact: State-Specific

Key Theme: Plant Health (RESEARCH)

MAES Plan of Work: GOAL 1: Program 7, Understanding Physiological Processes Impacting Production and Quality Traits in Cropping Systems; Program 8, Genetic Enhancement in Plant Production Systems; Program 9, Crop Production and Management Strategies; Program 11, Green Industry; Program 13, Agricultural Information Technology

a. Description

Progress in plant health research for this report focuses on recent findings in control of potato diseases, and soybean cyst nematode control.

Potato is the most important vegetable crop in Minnesota. All current varieties have weaknesses, and potato producers and processors are seeking replacement varieties resistant to the various diseases, pest and viruses. Potato late blight is currently the most serious regional and national threat to the U.S. potato industry. Since 1995, new fungicide resistant strains of late blight have emerged and no commercial variety is

resistant. The application of chemical fungicides to control late blight can also have the negative effect of enhancing peach aphid outbreaks. Minnesota potato growers report high green peach aphid populations, which coincides with intensive fungicide sprays to control late blight. In 2000-2001, the percentage of Minnesota seed potatoes rejected in winter tests because of virus infection was 47 percent. Faced with such losses, Minnesota's certified seed potato acreage declined 58 percent from 1995 to 2001. Practical and effective solutions to the management of potato viruses and green peach aphid are urgently needed to ensure the continued economic viability of the $60 million seed industry. Ultimately, the entire potato industry is dependent upon the availability of "clean" (virus-free) seed.

An aphid monitoring network, Aphid Alert, has run continuously since 1998. Data from this suction trap and pan-trap network provides grower with near real-time information on flight activity of key aphid vectors. Prior to the establishment of Aphid Alert, potato growers had no information on which to base aphid pest management decisions.

Conclusions and progress from research includes:

- Research has established that green peach aphids do initially colonize potato fields at edges and subsequent dispersal across the field takes 10 to 14 days. This provides a temporal window within which targeted border treatments can be effective for managing early season populations of the aphid.
- An extensive aphid-trapping network to monitor aphid flight activity regionally expanded to 26 locations across five states. Preliminary models have been developed using aphid capture data. The model accurately predicted current-season seed lot rejections in Minnesota winter grow-outs due to potato leaf roll virus.
- A weather monitoring network has been deployed to provide hourly data to help producers forecast conditions favorable for late blight disease development, allowing them to apply fungicides with more accurate timing.
- Researchers are identifying late blight resistance among wild potato populations and incorporating resistant genes into plant breeding. They have succeeded in developing bridging-hybrids having late blight resistance.

The soybean cyst nematode was first detected in Minnesota in 1978, and in the ensuing years SCN infestation has been confirmed in 52 counties statewide. The nematode is now a major soybean production problem in the state. Researchers have been working to develop nematode management with non-pesticide approaches. They have evaluated SCN-resistant cultivars on commercial farms across southern Minnesota. Overall resistant cultivars suppressed SCN population densities and increased soybean yield in infested sites. Biological control of SCN with two fungi also was investigated in the laboratory, greenhouse, and in fields. The results of this research are a significant contribution to basic understanding of the ecology of SCN and plant-parasitic nematodes in general. With the use of fungal agents, resistant cultivars may be used more efficiently.

b. Impact

Some seed potato producers are beginning to adopt targeted applications for their first application. If this technique is adopted by all of the seed producers in the region, it will result in a decrease of 11 metric tons of active ingredient being applied annually. Conservatively, this practice could save growers 70-to-80 percent for the first application. Growers are very receptive to this approach because it has the potential to greatly reduce their control costs.

Availability of near real-time information on vector flight activity has enabled Minnesota and North Dakota seed potato growers to make more informed pest management decisions. This has resulted in reduced insecticide costs because treatments are more precise. The president of the North Plains Potato Grower's Association has estimated that economic benefits of access to this information exceed $3 million per year for the Minnesota and North Dakota potato industry.

One estimate of the value of Aphid Alert by the Northern Plains Potato Growers Association was that by following Aphid Alert advisories, the Minnesota and North Dakota potato industry saved over $6 million in 2000 and 2002.

Aphid Alert has enabled growers to make more informed aphid/potato virus management decisions. One large grower estimated that having access to timely information on aphid flight activity saved their operation more than $60 per acre in 2001.

Economic savings from reduced pesticide applications due to better late blight forecasting can be estimated this way: A hypothetical reduction of two fungicide applications a year would save farmers $20/acre. This translates into a savings of $1,640,000 to families producing potatoes on the estimated 82,000 acres in Minnesota.

Soybean cyst nematode can cause an average 4 percent yield loss in an infested region. Saving one percent of the yield loss would be more than $10 million annually.

c. Source of Federal Funding: Hatch

d. Scope of Impact: Multi-State

Key Theme: Agricultural Profitability (RESEARCH)

MAES Plan of Work: GOAL 1: Program 1, Agricultural Production and Farm Business Management; Program 2, Agricultural Marketing and Distribution; Program 4, Physiological Processes Impacting Production and Quality Traits in Agriculture Animals;

Program 7, Understanding Physiological Processes Impacting Production and Quality Traits in Cropping Systems; Program 13, Agricultural Information Technology

a. Description

There are about 79,000 farms in Minnesota, many of which produce corn. Cash receipts from marketing this corn were almost $1.2 billion in 2000, a figure that does not include the value of corn used on the farm for livestock feed. Research has been ongoing to evaluate the benefits and costs of the adoption of new technologies such as Bt corn, which may provide farmers with better control over the European corn borer (ECB) and corn rootworm, and variable rate nitrogen and herbicide applications, which may allow farmers to use costly farm inputs more efficiently. In 2001, 24 percent of the six million acres of corn planted in Minnesota was planted with Bt corn for ECB control. Estimates of yield loss due to ECB were obtained by taking advantage of field experiments using Bt corn. Field experiments on corn response to nitrogen were used to estimate the potential value of variable rate nitrogen applications.

Other research on nutrient management for Minnesota cropping systems has determined that a 120-cm soil nitrate soil test in the fall or spring was the best predictor of how much N needed to be applied to sugar beets. This more accurate tool resulted in reduced recommendations of N application in both southern Minnesota and, to a lesser extent, in the Red River Valley. Preliminary results from field experiments in southern Minnesota confirmed researchers' recommendations.

Soybean was harvested from 6.8 million acres of Minnesota cropland in 2002. With an estimated average yield of 43 bushels per acre (a record yield), Minnesota's total soybean production may be near 310 million bushels. Minnesota's huge soybean crop has netted farmers around $1.5 billion annually over the past decade. In recent years, soybean has been often mentioned as Minnesota's most profitable crop. However, returns on investment have become exceedingly small. Soybean production research at the University of Minnesota focuses on production strategies that minimize inputs while maintaining yields. New soybean planting recommendations were developed based on four years of multi-site row spacing by population studies. Recommendations for the use of fungicide seed treatments and rhizoid inoculants were modified based on four years of product trials throughout the state.

A climate and soils database has supplied crop advisors and producers with soil temperature data so that they can assess the optimal time for planting and spreading herbicides and fertilizers into the soils. Researchers have developed web-based decision aids for Best Management Practices based on climatic probabilities. These aids are accessible to the public on the web. Work began on the web site in 1995 and has continued in stages. The interactive portion of the web site has been available since 2000. Monitored usage has increased substantially, and it now averages 1000 accesses per day.

Long term climate monitoring and analysis that has been conducted by U of M researchers over many decades has been developed into a database with 120 or more years of daily climatic data. It has been used in several ways to aid producers and other Minnesotans. For example, the database has been used to assess the historical probability for snow amount and prevailing wind direction in a given point in the landscape to use in the design of living snow fences. Effective deployment of more living snow fences could vastly reduce the amount of tax dollars allocated to local and state governments for keeping roads and highways open during winter months. It is estimated that for each dollar invested in living snow fences, there is a cost savings of $17 to the Department of Transportation. Farmers can contract and be reimbursed by the DOT for planting and maintaining living snow fences, providing income supplements for farmers. The database provides the DOT with tools for negotiating with landowners.

Another kind of database—the Minnesota Agricultural Transportation Database—is providing information on crop production and feed use by county, and estimated agricultural transportation needs by county. County feed deficit/surplus estimates are being used by commodity groups and area businesses to assist in finding locations for new or expanded value-added activities. A specific example of the use of the database was the sharing the data with southwestern Minnesota elevator operators who are attempting to export grain and soybeans directly to locations in Mexico. Also, the database is shared with businesses and officials interested in increasing livestock and diary operations in feed surplus areas.

Honeybees are the primary pollinating insects in North America. An estimated $14 billion worth of agricultural commodities depend directly or indirectly on honeybee pollination. Two parasitic mite pests of honeybees were introduced into the U.S. in the 1980s, and these mite pests have had a devastating effect on honeybee colonies and beekeeping businesses throughout the U.S. Control measures for the mites have dramatically increased operating costs for beekeepers and many have gone out of business, resulting in a decline in national honeybee colony counts. U of M researchers have bred a line of honeybees for hygienic behavior. Hygienic bees are able to detect and remove diseased brood from the nest, eliminating the disease before the pathogens reach the infectious stage. The hygienic line is highly resistant to American foulbrood, and chalkbrood, a fungal disease. Researchers have been testing hygienic colonies to determine if the behavior would also provide sufficient resistance to the parasitic mite, *Varroa destructor*. Results indicate that hygienic colonies have significantly fewer *V. destructor*, less disease, and produced more honey than unselected, commercial colonies for up to one year without treatment.

Many Minnesota dairy operations are at a crossroads. They have four choices: expand, stay the same, leave the business or move to a grazing system. Research to provide benchmarks for production costs and profitability for rotationally grazed dairies is giving producers needed information to achieve profitability. Initial comparison results show that milk production is approximately one-third lower for pastured dairy cows, a figure that is somewhat offset by slightly lower input costs.

There are also lower start-up costs. The information on profitability and variability of profitability will help those who are deciding whether to change from a traditional to a grazed dairy operation or whether to enter the dairy industry, especially where start-up capital is a concern. A comparison of costs showed that grazing heifers from 400 to 700 pounds in pastures rather than feedlots could result in a savings of $.59 per head per day.

b. Impact

Results from Bt corn research have been used by the Environmental Protection Agency in its formulation and evaluation of regulatory policy for managing ECB resistance to Bt corn. More recently, estimates of yield loss from ECB have offered farmers information they can use to evaluate the benefit of controlling ECB based on the historic frequency and severity of infestation experienced on their own farms.

The reduction of Nitrogen inputs in the watershed areas of southwestern Minnesota could be 20 to 50 lbs N/acre/yr. This impact could be for 125,000 acres and result in a savings of $1,125,000 while maintaining grain yields at the present level. The reduction in optimum N fertilizer recommendation for sugar beets grown in Minnesota could be 30 lbs/N/acre/yr for up to 500,000 acres for an economic savings of $3 million, while actually improving the quality of sugar beets processed. Research findings from the project evaluating phosphorus fertilization have been adopted by growers in Minnesota. Reports from two producers in 2002 indicate that following University of Minnesota fertilizer recommendations for phosphorus based on this research saved $50,000 to $77,000 in corn production costs on each farm operation.

Soybean production recommendations developed from research are presented to thousands of Minnesota soybean producers each year. While many of the recommendations developed increased production efficiency or decreased inputs incrementally, the huge number of acres that the soybean crop occupies in Minnesota magnifies small percentage changes in economic returns. For instance, a one percent increase in soybean production statewide would translate to an infusion of dollars to Minnesota's economy of about $15 million.

An evaluation of the interactive climate and soils database on the web has confirmed the database's value. Seventy-to-eighty percent of evaluation respondents said that they have found the information very useful in their decision-making. The Minnesota Irrigation Association has used the database to determine irrigation schedules, and some users have commented on more efficient use of water for irrigation. The profit margin for crop producers in Minnesota is so narrow that improved efficiency or lower costs at any level are seen as significant. As one example, Minnesota's sugar beet and potato industries have reported that the weather database has helped them examine the potential for disease development. This has helped reduce the number of spray operations for fungicides, which could allow them to reduce input costs. The database could also help corn and soybean farmers achieve yield increases of 2-to-5

bushels per year, which for many farmers translates into annual income increases of several thousand dollars. Water savings of 2-to-5 acre-inches per year in irrigation could also save a few thousand dollars per year.

Wild oat remains the number one weed control problem in small grains in Minnesota. The cost of controlling wild oat is between $15 and $22 per acre. Field research is on- going to determine the influence of reduced herbicide rates, growing degree-days, and seedling emergence for wild oat control in spring wheat and barley. The results of this research to date have enabled small grain producers to reduce their wild oat herbicide rates by 15 percent. This research project is a cooperative project between the University of Minnesota, North Dakota State University and the USDA.

The hygienic line of honeybees bred by U of M researchers is now available commercially through a bee breeder in southern California. The line is distributed nationwide and beekeepers are realizing the benefits of using resistant stock.

Small to moderate size dairy farms can benefit from the dairy grazing research results. Agricultural lenders who support dairy farming will also be helped, as they will have data from which to judge the financial viability of grazing dairy operations.

c. Source of Federal Funding: Hatch

d. Scope of Impact: Multi-State

Key Theme: Food Safety/Food Borne Illness (RESEARCH)

MAES Plan of Work: GOAL 2

a. Description

Food and water-borne diseases are a major public health concern because more than 70 million people are affected and approximately 5,000 die each year in the U.S. Food-borne pathogenic bacteria cause more than 4 million infections and they cost $6.9 billion per year to the American economy. Among these bacteria, Salmonella and E coli are two of the most important. These pathogens are easily killed in processed foods, but they can survive in raw, fresh and minimally processed products. These pathogenic bacteria are normally present in the gastrointestinal tract of livestock and they can easily be transmitted via manure. Because fresh and minimally processed foods do not have a kill step in their process, it is critical to develop methods of control at the farm level to stop the dissemination of these bacteria from animals. Manure and livestock drinking water have been identified as sources for environmental spread of these pathogens. U of M researchers have been developing treatment methods to reduce the level of these bacteria in manure and water, based on the unique antibacterial activity of carbonate. Research found that solutions

containing sodium carbonate completely reduced the viable count of pure cultures of E. coli, Salmonella, and a variety of other enterobacteria. The antimicrobial effect of carbonate appears to be significantly more effective in liquid medium than in manure. With approximately 4 grams per liter of sodium carbonate, a complete reduction of viable pathogenic bacteria can be achieved in a few hours in water or liquid media. Based on these results, researchers are investigating the application of sodium carbonate to treat drinking water in water troughs to prevent the spread of E.coli within herds.

Other research has been making progress is providing rapid and reliable diagnostics to detect food borne pathogens in food items—particularly in eggs, milk and meats. The research focuses on developing a technique that is uniquely designed to detect generic species (i.e., identifying all strains in a single diagnosis of Salmonella and E. coli.) In collaboration with a Wisconsin state lab, researchers have had successful results testing for both generic strains of E. coli and Salmonella. The method developed by this project will help to improve management at the farm level for producers of all sizes. It will allow the detection of all Salmonella and E.coli strains both in the environment and in the herds themselves. This would allow farmers to plan for eradication, sanitation and management before the animals are marketed, which could minimize time, resources, and costs.

Bacteria-contaminated acidic foods such as apple cider and fermented meat products have been responsible for several outbreaks. The acid resistance of E. coli allows this microorganism to even survive the acidic gastric juice of the stomach. An applied research project is aimed to provide a better understanding of the acid resistance trait of E. coli and design methods for reducing the ability of this food-borne pathogen to survive in acidic foods and the gastrointestinal tract. Research has found that an enzyme involved in the neutralization of acidic conditions known as glutamic acid dehydrogenase (GAD) is probably the most important component of the E. coli's acid resistance response.

Many producers and consumers of apple cider believe that both flavor and nutrients are destroyed by pasteurization. The focus of research is to identify methods that could be used as alternatives to pasteurization of fruit juices in satisfying food safety guidelines. The FDA has set a safety threshold of 5-log pathogen destruction for fruit juice manufacturing. This means that producers must destroy 99.999 percent of existing pathogens. Other researchers have considered a number of methods for killing pathogens, such as radiation, ultraviolet light, and ultrahigh pressure, without destroying the valuable nutrients in fruit. U of M research's main focus involves frozen storage of unpastuerized apple cider. Researchers freeze it to a certain temperature and hold it at that temperature for a certain length of time before thawing. After thawing, researchers refrigerate the juice for varying numbers of days to determine corresponding levels of pathogen destruction. They have successfully developed a freezing and thawing regime that meets the FDA guidelines relating to alternative methods to pasteurization to achieve food safety. Frozen storage is a simple process that can be done at the orchard without elaborate equipment.

Gastrointestinal disease outbreaks are increasingly linked to eating fresh fruits and vegetables. They are considered high-risk foods because they are minimally processed and are susceptible to contamination by fecal material or soil at the farm. Because organic produce is only fertilized with organic materials such as animal manure, it has been suggested that they might contain relatively higher amounts of pathogenic bacteria, but very little evidence supports these claims. A number of Minnesota farmers have successfully turned to organic farming, increasing the economic importance of organic agriculture for the state. Minnesota ranks among the top six states in both vegetable crop and organic crop production. Only one food-borne outbreak has been linked to U.S. organic produce, but media reports questioning the safety have challenged consumer acceptance. U of M researchers are engaged in the first systematic approach to determining the microbiological quality of organic fruits and vegetables. Twenty-five organic farmers are participating the study. Samples of composted manure have been collected as well as produce samples. No sample has tested positive for either Salmonella or E. coli, indicating that organic produce is safe.

Another research project has taken up the question of how to maintain safety and quality in the increasing consumer trend toward natural foods. This research has been studying selected naturally occurring phenolic compounds from edible plants that have the potential for improving the safety of food products. Researchers have demonstrated the antimicrobial properties of certain phenolic compounds found in the parsley and citrus families on specific spoilage and pathogenic bacteria. Recent research has focused on hazelnuts, grain flours, and bacteria that naturally produce anti-microbials. Some results:

- Researchers have found that crude methanol and water extracts of American and Turkish varieties of hazelnuts inhibit the oxidation of linoleic acid in a phosphate buffer/water system. Experiments also suggest that tannin-like compounds may be involved in inhibiting oxidation. Thus, these tannin compounds could be isolated and used in breeding of special hazelnuts, as well as extracting them for use as a natural additive to other foods.
- Experiments indicate that a similar fraction of flour inhibits oxidation as that of hazelnuts. The greatest antioxidant activity emanates from whole wheat flour extract, while the weakest antioxidant activity comes with refined wheat flour extract.

b. Impact

The reduction in the incidence of contamination of meat, fruits and vegetables by these food-borne pathogens could reduce the number of recalls and outbreaks that not only cost millions to the food industry but also have a very negative impact on the consumer's perception and demand.

Food industries that produce acidic foods such as apple cider will be benefited by the identification of alternative food additives that would ensure the safety of their

product. The use of those acid food additives could also be adopted by the meat industry to achieve more effective carcass rinsing methods to reduce the E.coli contamination of meat.

Participating organic farmers recognize that they will benefit from this study by receiving objective measurement of current bacterial loads present on their products and information identifying management practices that increase their risk of having produce contaminated with food-borne pathogens.

The immediate purpose of the frozen juice storage research is to help the 15 small-scale apple producers in Minnesota manufacture apple juice themselves by developing a new process that is more simple and inexpensive than pasteurization. On a larger scale, however, the work is applicable to a broader spectrum of fruit producers and juice manufacturers everywhere.

Researchers are working with a local food processor to assess quality implications of the research findings, and with a public health researcher to identify potential health implications of related diets. The main application for selection of certain flours and milling techniques would be to maximize the concentration of positive compounds in flour-related foods and resulting products.

c. Source of Federal Funding: Hatch

d. Scope of Impact: Multi-State

Key Theme: Human Health (JOINT)

MAES Plan of Work: Goal 3

Extension Plan of Work: Goal 3, Natural Resources and Environment Capacity Area: Housing, Technology, Energy, and Air Quality

a. Description

Research: Recent studies have linked greater soy intake with lower breast cancer risk for women. One interpretation has attributed this link to higher production of cancer-preventative substances when a woman consumes more soy. U of M research is taking a different approach. A nutrition researcher suspects that it is not merely soy intake, but rather the individual profile of bacteria in the colon that determines production of these substances, and therefore cancer risk. He studies has found that differences in phytoestrogen metabolism influence plasma hormone levels. Only 30 to 40 percent of the female population excretes equol, a metabolite of soy. Research showed that women who excrete equol have hormone profiles consistent with low risk of breast cancer. This data suggests that women who get breast cancer may

metabolize phytoestrogens differently from health women, regardless of soy intake. Another study has confirmed the cancer fighting benefits of flax. Adding merely five gram of ground flax to the diet resulted in an increase in protective estrogen levels.

Colon cancer is one of the most common cancers in the U.S. While research has helped to lower the chance of death and improve the quality of life for people with this disease, nearly 48,000 Americans still die from colon cancer every year. U of M research seeks to better understand the relationship between colon cancer and dietary intake of beef protein and tallow.

In recent decades, a great deal of health-related research has focused on identifying dietary chemicals that could decrease the risk of cancer. While most such chemicals originate in plants, conjugated linoleic acid (CLA) is one compound found in diary and ruminant meat products that is considered to be very promising. Researchers have been investigating the anti-carcinogenic effect of CLA found in butterfat in protecting against colon cancer.

Other research looks at social-environmental influences in nutritional choices. A primary task of this research has been to identify specific behaviors that enable adequate consumption of fruits and vegetables for 9 to 12 year-old children. Researchers estimated total fruit and vegetable intake based on 24-hour food records that were kept by a group of Twin Cities' students. They found that behaviors associated with higher intake included starting the day with juice or fruit, asking parents to buy fruits and vegetables for meals and snacks, and eating extras servings of fruits and vegetables for meals and snacks. Other research with low-income mothers identified behaviors that were predictive of intake and stage of change, including starting the day with juice or fruit, eating vegetables at the evening meal, or eating three meals a day.

Extension: A "Healthy Indoor Air" campaign was conducted in the seven-county Twin Cities metro area as part of an initiative to address the health risks to children of second-hand smoking. "Does Your Home Get a Healthy Bill of Health" trained 194 community leaders at seven metro locations to deliver information to parents and others on second-hand smoke, radon, mold, dust, and other environmental hazards especially dangerous to children. These leaders, in turn, taught the information to more than 2,800 local residents during the three months following the train the trainer workshop. The focus was on identifying sources, health effects, and controls for common indoor air pollutants, understanding the general aspects of home building science and residential indoor air quality, and recognizing appropriate roles for pollutant testing and current action research projects. Civic presentations, health fair displays, educational workshops, and newspaper and newsletter articles featuring this "Just in Time" research response reached an estimated 100,000 households. "Aging in Place" and "Universal Housing Design for Home Buyers, Remodelers, and Apartment Dwellers" educational programs offered 10 workshops to 300 participants and self-study information to another 400 participants.

b. Impact

Research: Basic research into the effects of diet on hormones paves the way for applied research into possible dietary supplements and dietary recommendations to prevent hormone-dependent cancer. Flax oil—the edible version developed at the U of M—provides one of the Omega-3 acids proven to prevent cancer.

Research has shown that the consumption of beef tallow does not increase colon cancer risk. Indeed, it may be slightly protective. Findings could lead to the introduction of new value-added products, such as functional foods or neutraceutical foods that may reduce risk of colon cancer.

One promising aspect of Conjugated Linoleic Acid (CLA) is that it is anti-carcinogenic at far lower dosages than many other anti-carcinogens that occur naturally. Some estimates suggest that normal human intake of CLA from dairy products already provides as much as one-third of the amount that is necessary for cancer protection. The ultimate impact of this basic research is to improve human dietary patterns that could in turn reduce the risk of disease.

Nutrition research results are helping to develop intervention strategies to increase consumption of fruits and vegetables for target populations.

Extension:

- More than 300 Dakota County families (representing a total of more than 1,100 family members) took the EPA "No Smoking in Our Home" pledge as a result of the "Healthy Indoor Air" campaign.
- A pre-post evaluation of the 194 trainers in the "Does Your Home Get a Healthy Bill of Health?" workshop got an 84 percent return rate (171 responses). Following the training,
    - ✓ 88 (51 percent) were able to list options for making indoor air quality decisions—only 32 said they could prior to the workshop.
    - ✓ 68 (40 percent) were able to evaluate indoor air quality decisions after training—only 37 were able to do so previously.
    - ✓ 78 participants (46 percent) stated that they could take control of personal goals and future indoor air safety and 75 (44 percent) had reflected on the impact of earlier remodeling or building decisions.
    - ✓ 54 (32 percent) left the workshop ready to make air quality presentations in their communities; 12 felt they needed additional time to prepare themselves for their training assignment.
- An independent audit of the impact of in-home consultations on mold clean-up and moisture remediation and actions taken by homeowners during 2000-02 was conducted to determine if Dakota County citizens wanted their tax dollars spent on this type of effort. 46 of 106 families that were referred to Extension by FEMA and received consultation on flood clean-up, insurance, family stress, health implications, and community resources during flooding in 2000 were contacted.

- ✓ 100 percent said it was appropriate for Extension to provide information on repairs and recovery.
- ✓ 100 percent said it was a good use of tax dollars.
- ✓ 90 percent said that Extension was responsive, effective, and efficient in its delivery and had taken advantage of the evening and weekend hours provided during the disaster.
- ✓ 95 percent said the information they received was timely and beneficial.
- ✓ 65 percent had changed their clean-up or repair timeline to follow Extension guidelines.
- ✓ 90 percent followed Extension advice and as a result, did not need to re-do repairs because of further mold damage.
- ✓ 85 percent would and have recommended Extension to friends, family members, or co-workers as a result of their experience.
- ✓ Only 49 percent had been aware of Extension's services prior to their flood experience.

c. Source of Funding: Hatch and Smith-Lever 3b&c

d. Scope of Impact: State-Specific

Key Theme: Forest Resource Management (JOINT)

MAES Plan of Work: GOAL 4: Program 1, Maintaining Forest and Natural Resources

Extension Plan of Work: GOAL 4, Natural Resources and Environment Capacity Area: Agroforestry, Environmental Learning and Leadership--Natural Resources in Your Backyard, Productivity and Environmental Quality for Private Lands and Business, Sustainable Natural Resource Management and Stewardship—Sustainable Forest Management, and Woodland Advisor Programs

a. Description

Research: The effects of logging on ecosystem sustainability are controversial. Surprisingly, existing data is inadequate to allow a comprehensive evaluation of logging effects on biodiversity, composition and productivity, since appropriate comparisons of stands of similar ages and differing disturbance histories are rare. U of M researchers have studied 2,000 plots on 80 forest stands in northern Minnesota. They compared naturally regenerated aspen, jack pine and black spruce stands established after either logging or wildfire, with stands that are 24 to 40 and 70 to 100 years old to determine whether logging has resulted in greater or lesser plant diversity. Research found that the younger stands established after logging had higher diversity of trees, herbs and grasses than post-wildfire stands. Otherwise, they found no evidence of differing species diversity, composition, productivity or nitrogen cycling in forest stands of comparable age and forest type between the two. Although

there is evidence that logging has increased the proportional landscape dominance by aspen, this research refutes the idea that disturbance by logging has diminished stand-scale productivity or plant diversity in comparison to the common natural disturbance, wildfire.

A 12-month visitor profile survey in six communities across the state, including four in forested regions was completed. Results are helping understand why people visited, what it would take to attract more to stay longer, and what an individual business can do to increase its market share even if the size of the market does not expand. Business and leisure travelers were identified for each community.

Timber and pulpwood consumption for the Lake States and the U.S. has steadily increased since the mid-1980s and is expected to double by the year 2040. However, available timberland has already declined by 3 million acres in the Lake States during the past 20 years. U of M researchers seek to help facilitate a large-scale planting program with genetically improved larch species. Supplementing the overall wood supply stream with larch would significantly increase the softwood fiber supply in the Lake States and northeastern U.S. The ultimate goal is to establish a sustainable, economically viable process for balancing supply and demand for timber in the coming century.

The Cloquet Forestry Center supports multiple research projects. One example of recent research at the Center is work to help develop new methods for regenerating and growing eastern white pine. Once nearly written off as a viable commercial species in Minnesota because of severe deer browse, white pin weevil and white pin blister rust, a comprehensive research program is yielding solutions for many of the problems.

The Sustainable Forests Education Cooperative held 17 workshops on subjects including timber harvesting, landowner cooperatives, management of small woodlots, non-timber forest products, agroforestry systems, and non-timber forest products.

Extension: Minnesota has a great deal of potential for expansion of agroforestry due to the nature of its land base and current and potential markets for agroforestry products. Agroforestry also provides many environmental and economic benefits to Minnesota citizens. Extension educators provided a variety of workshops and trained "Woodland Advisor" volunteers to assist private landowners in learning about agroforestry and its potential economic and environmental benefits. These programs reached over 2,800 people and involved 45 Woodland Advisor volunteers last year. Seventeen new Woodland Advisors received 45 hours of training in forestry information and skills, to enable them to reach out to other private woodland owners and persons interested in the environment. Private woodland owners learned about growing hybrid aspen and cottonwood—essential species for wood fiber production in NE Minnesota. Other programs taught woodland owners the phytosanitary standards for the pallet industry and information from the Sustainable Forestry Incentives Act. Conservation programs focused on encouraging landowners to

consider Living Snow Fences, Continuous CRP, Shelterbelts, and EQIP to reduce soil erosion and water contamination. Participants in other workshops learned about other specialty forest products that they might harvest, e.g., maple syrup, baskets, and Christmas trees, wreaths and Balsam fir boughs. These programs together garnered more than $126,000 in federal and state grants and the value of in-kind contributions from industry and non-profits organizations. In addition, participants paid over $4700 in fees to participate.

b. Impact

Research: Logging study findings have been used in policy and management among industry groups and management agencies, such as the U.S. Forest Service.

Community tourism development organizations are using the research results to refine marketing plans. Research impacts suggest increased visitation to the forested natural areas of Minnesota mean increased economic activity for rural communities, helping to link the state's $9.7 billion industry to the forested rural areas to diversify struggling and shifting economies.

Researchers expect to achieve a significant increase in growth rate with every new generation of larch created. Within the first generation alone, there could be an 8 to 12 percent increase in volume growth of the larch population over the initial group of planted larch. At the same time, the research could improve the quality of larch so that larch could be used at the mills for pulp/fiber or paneling within the next 15 years. This would be a cheaper alternative than current sources because it grows faster in the field than other species.

An aggressive program for selecting, breeding and testing at the Cloquet Forestry Center is yielding positive results in the search for trees genetically resistant to blister rust. As a result, in the future, Minnesotans should once again witness white pine as a major component of northern forests.

Extension: Agroforestry programming is still developing so detailed evidence of impacts is not yet available. Still, these programs are already indicating that there are economic and environmental benefits from diversifying beyond traditional agronomic crops and producing specialty forest products, especially in regions of the state where production of agronomic crops is more marginal.

- Producers are planting hybrid aspen and poplar and cottonwood that will provide raw material for the growing wood fiber industry.
- Agroforestry workshop participants are eager to learn and one educator reported that 100 percent of his 120 private woodland owners adopted at least one new practice to improve land management, reduce risks, and improve profitability.
- Programs in the Arrowhead Region have resulted in tax incentives, formation of local cooperatives, alternative agroforestry crop production, and improved business practices and profits on private woodlands adjacent to federal and state-owned public forestland.

- More than 30 new Living Snow Fences have been planted in south central Minnesota in the last two years.
- Woodland Advisor volunteers increased their knowledge of forestry information 25 percent, measured by pre and post assessment.
- Fourteen Regional Extension educators also were trained in forestry knowledge and skills, developing a core team for additional program expansion.

c. Source of Federal Funding: Hatch and Smith-Lever 3b&c; McIntire-Stennis

d. Scope of Impact: Multi-State

Key Theme: Drainage (RESEARCH)

MAES Plan of Work: GOAL 4: Program 5, Water Resource Management; GOAL 1: Program 13, Agricultural Information Technology

a. Description

Subsurface tile drainage systems for agriculture provide tremendous agronomic benefits and have been an important part of agricultural development throughout the country and world. Subsurface drainage systems are associated, however, with both positive and negative environmental effects. These systems typically exacerbate nitro-nitrogen losses from agricultural fields. Many studies show that alternative drainage design and management techniques can potentially reduce some of the negative environmental impacts of subsurface drainage. Comprehensive research involving field and laboratory research, computer modeling and Extension education has been ongoing since 1998. In northwest Minnesota at the Northwest Research and Outreach Center and cooperating farms, field and modeling research is underway to determine the response of various crops to subsurface drainage, a practice that has been little-used in the region. Field research plots host sugar beet, wheat and soybean trials for drained and undrained conditions. Computer modeling is being conducted using existing drainage simulation models. Fifty-to-100 year climatic records have been developed for south-central Minnesota to run computer simulations. An agricultural drainage publication series was begun in 2001 focuses on drainage issues. Research results show 15-to-20 percent decreases in nitrate-nitrogen loss using improved drainage design and management. Initial results from 2001 and 2002 show 10-to-20 percent increases in crop yield due to subsurface drainage.

In other research on eroded soils, gravel inlets were installed in place of open surface tile inlets at three sites being cropped in a corn-soybean rotation. Flow and pollutant concentrations were monitored above and below the gravel to evaluate the effect of the gravel on flow and contaminant losses into the drainage system. Concentrations of particulate contaminants in runoff were reduced by the gravel.

A larger ongoing soil survey research project has implications to drainage issues, not just on agricultural land, but land with other uses. One example: researchers have been working with Nerstrand Big Woods State Park near Northfield, Minnesota, to help park staff understand the cause of severe gully erosion in parts of the park and also loss of trees. Researchers relied on soil survey data to help park staff understand the hydrologic and soil processes that caused the erosion and provided them with information to help relocate trails and minimize public use of certain vulnerable areas.

b. Impact

A comprehensive website devoted to drainage was established in 2001. The website, "The Drainage Outlet," has connected thousands of individuals to drainage educational resources. A joint drainage research forum is held annually with Iowa State University to both inform and seek input from state agency staff, local decision makers, and producers on research priorities and direction.

Research on management of eroded soils has shown that settling during ponding at open surface inlets can reduce particulate contaminant losses. Gravel filters can further reduce contaminant losses. This can potentially have a major impact on water quality in drainage basins with poorly drained soils such as the Minnesota River basin.

Conservation efforts as a result of soil information will ensure that the park's thousands of annual visitors are able to continue enjoying the park without damaging it further.

c. Source of Federal Funding: Hatch

d. Scope of Impact: Multi-State

Key Theme: Water Quality (RESEARCH)

MAES PLAN OF WORK: GOAL 4, Program 5, Water Resource Management; Program 6, Animal Waste Management

a. Description

Grazing systems are currently exempted from environmental regulations, but the situation is temporary and producers and regulators are seeking science-based information to guide future rule revisions. One component of research on grazing systems has been to evaluate water quality impacts of alternative livestock wintering approaches. One method being evaluated, with the cooperation of a private dairy farm in central Minnesota, is wintering livestock outdoors with a bedded manure

pack. The bedded pack absorbs moistures and provides a dry area for the livestock. The bedding also retains the nutrients, preventing them from being lost to surface water. Water monitoring equipment was installed to measure runoff from the wintering site and to test it for water quality. While the main interest is monitoring runoff during the snowmelt period, the equipment was installed to monitor throughout the summer months as well. Runoff was found to occur from the site on only two days during the summer. The limited amount of runoff indicates that the bedding absorbed precipitation effectively.

A 1999 White House advisory Committee on the Environmental and Natural Resources (CENR) said Mississippi River nitrate levels are three times higher now than in the 1950s. An alarming 56 percent of the N put into the Mississippi River has been traced to five heavily farmed midwestern states including Minnesota. CENR proposed a 30 percent reduction by 2015 of fertilizer use by midwestern farmers. Even best management practices with current cropping systems, dominated by annual row crops, will not reach this goal. High levels of nitrate-N and low levels of several herbicides leach into drainage water under millions of acres of corn and soybean in Minnesota. U of M research suggests that perennial cropping systems could reduce drainage and increase plant nitrogen uptake. Thus the search for economically viable perennial cropping systems has been intensified.

Pasture-based livestock production systems have improved the quality of life of farmers, reduced erosion, decreased fertilizer and chemical runoff, and reduced animal stress. However, the profitability and increased use of grazing systems are currently limited by a lack of dependable, high quality forage during the summer.

Researchers have been studying whether widespread re-introduction of Illinois bundleflower could address some key profitability limitations of pasture-based livestock systems, and thereby promote greater use of pastoral systems. Research has identified three populations for potential variety release for pasture and restoration. Established stands of two Illinois bundleflower populations were subjected to one or two cuttings per year to determine its response to forage harvest regimes. Mixtures of Illinois bundleflower with various native warm-season grasses were seeded at multiple locations. Preliminary results suggest that Illinois bundleflower has great potential for grazing by ruminants. Comparison of Illinois bundleflower forage to alfalfa forage showed the two forages were similar in digestibility, crude protein degradation and bacterial N flow.

Potato production in Minnesota is moving from heavy clay soils of the Red River Valley to glacial outwash regions of central Minnesota. The reason for this change is an ample irrigation water supply in sandy outwash regions that results in higher and more consistent potato yield. With this change, there is a concern about the effects of current irrigation and nitrogen management practices on groundwater quality. Studies have shown that nitrogen concentrations in ground water have been steadily increasing under intensively farmed sandy outwash soils of central Minnesota. Research evaluating the use of alternative management practices in potentially

minimizing nitrogen leaching from central Minnesota outwash soils have identified viable options for reducing nitrogen leaching without significantly impacting tuber yield or quality.

Another study has assessed the potential of phosphorous leaching from potato-processing companies wastewater application at cold temperatures. It concluded that even at cold temperatures there is some likelihood of phosphorous leaching from wastewater application on sandy outwash soils that have previously been overloaded with phosphorous. Also, at cold temperatures there is less adsorption of phosphorous by soil from wastewater. The combination of both these factors suggests that wastewater application during winter (as proposed by some food processing companies) on sandy outwash soils poses an increased risk of groundwater contamination and therefore should not be allowed by the Pollution Control Agency.

The U of M Soil Testing Laboratory (STL) services more than 4,000 governmental and private customers each year. One main goal of the work of the laboratory is to prevent negative environmental effects from human activities on land. Proper application of fertilizer in a way that prevents pollution is a direct benefit to the lakes, rivers, streams, wetlands, ground water, farm fields and backyard gardens around Minnesota. The STL assists in protecting water quality by helping land users reduce leaching or runoff from over-application of fertilizers.

b. Impact

Information about alternative management practices for irrigated potatoes has been disseminated to producers and government agencies such as the Minnesota Pollution Control Agency and the Minnesota Department of Agriculture, Extension meetings, and research reports. As a result, many producers in the area are now adopting the use of split application of nitrogen fertilizers.

The Soil Testing Laboratory has also supported lake associations and city governments throughout the state in educating their clients and stakeholders in proper fertilizing practices. In one example, lakeshore owners were offered free soil tests courtesy of the association and then the results were used as a starting point for discussion about keeping nutrients out of the lake. Many local community beautification and water quality projects have been assisted by information from the STL. For example, a greening project along the Mississippi River in St. Paul used information from the lab's soil analysis to help plant a large number of trees along the riverbanks. The lab also developed a new test for high soil phosphorus levels. Called the nutrient management P test, it evaluates the soil phosphorus level and helps to determine if further application of phosphorus in the form of manure can lead to an unacceptable risk of phosphorus run-off from the land. Excess phosphorus in field run-off can contribute to eutrophication of our lakes.

c. Source of Federal Funding:

d. Scope of Impact: Multi-State

Key Theme: Multicultural and Diversity Issues (JOINT)

MAES Plan of Work: GOAL 5

Extension Plan of Work: GOAL 5, Agriculture, Food, and Environment Capacity Area: New Immigrant Farmer and Farming Incubator Program; Community Vitality Capacity Area: Building Cultural Understanding, Building Inclusive Communities, and Diversity and Inclusion; Family Development Capacity Area: Project FINE: Focus on Integrating Newcomers Through Education

a. Description

Research: An underdeveloped yet increasingly important area of research focuses on mental health services with Latino/a populations. Increase in minority populations has not translated into improved mental health services for most ethnic minority groups. NIMH's National Advisory Mental Health Council has identified translational behavioral science research as one of their three priority areas. They list the need for studies that incorporate contextual factors such as ethnicity and culture to help bridge clinical and service research. U of M researchers have interviewed Latino/a mental health providers and community members to better understand how to develop and implement effective mental health interventions for Latino/a communities.

Researchers are also focusing on the physical health of diverse populations. The overall objective is to examine the nutritional status and dietary behaviors for community populations in transition due to changes in economic status, environment, age or migration. The goal is to develop culturally appropriate nutrition intervention, when appropriate. For example, this year a project examining the role of self-efficacy in dietary and exercise behavior modification was implemented at the Golden Eagle Program in Minneapolis. Assessment tools were developed and tested with 80 urban Native American children. Baseline data on body composition, self-esteem, dietary intake and physical fitness were assessed for approximately 180 children.

Extension: Many newcomers have come to Minnesota in recent years—immigrants and refugees from Mexico, Southeast Asia, Africa, and other localities. The 2000 Census noted that Minnesota's population is becoming far more diverse than it has been. Recent terrorism has also led to local cultural violence, so programs that focus on understanding different cultures and welcoming new neighbors are more important now than ever. Extension educators worked with local school systems, police, sheriff, and local human services departments, school systems, Early Childhood and Family Education (ECFE) classes, and community organizations to deliver a variety of cultural awareness programs and activities. More than 11,000 people participated

directly in these programs and more than 1,200 people were trained to extend the programs to others in their communities. Over $719,000 was raised through grants and in-kind contributions from a wide variety of sources to fund these efforts.

Outcomes varied from community to community. Here are some examples:

- County government departments (public health, mental health, social services, corrections, and Extension education) in one county changed their outreach, education, and translator services to be more welcoming to immigrants, following a briefing from Extension educators.
- Public health nurses reported a 90 percent completion rate in teaching health practices and in enrolling clients from other countries in appropriate plans for well child follow-up medical and dental services after a "Cultural Health Update" provided by Extension staff.
- 95 percent of a random sample of participants in a program about being culturally sensitive to the changing demographics of the work environment said they'd gained new skills that would benefit them in addressing diversity in their work environments.
- All 450 youth and their parents in a "Multicultural Exhibition" had a conversation with a newcomer from another country to learn about their culture of origin and positive and negative experiences associated with living in the U.S.
- Representatives of 16 different community organizations participated in a "Welcoming Somali to Our Communities" program and reported re-teaching what they'd learned in other community settings to more than 1,200 other citizens.
- Students from diverse backgrounds formed a team called "Supporting Players" and made presentations about the impact of racism in public schools in their district.
- Following a regional "Diversity Day" training, 75 students started welcoming projects in 14 local school districts.
- 325 teachers were trained in methods of introducing cross-cultural understanding in their classrooms.
- Following participation in a "Minnesota Nice … or Not, Building Diverse Communities" workshop, a board member for a three-county Community Action Program reached more than 5,000 high-risk, income-eligible immigrant families with information about meeting their basic needs to successfully raise their families and contribute to their new communities.
- Participants gained more knowledge about family life, food, skills, customs, beliefs, values, and religion of Latino newcomers to their community.
- The interpreter network service in one county was expanded from 15 to 32 trained interpreters offering services in 9 languages. As a result, non-English speakers, as well as businesses and local agencies, are able to obtain interpretive services with less than 24-hour notice.
- Monthly meetings between newcomers and school and law enforcement officials, business representatives, and others are used to increase understanding and meet identified needs of newcomers.

Minnesota's New Immigrant Farmer and Farming Incubator Program worked with 518 people who want to become full-time or part-time farmers in 2002. Many immigrant families farmed small plots at the University's Rosemount Outreach Center in Dakota County, growing vegetables for themselves and for sale to others. Eight workshops were held for immigrant farmers prior to the 2002 growing season—four on Private Pesticide Applicator Training, two on vegetable crop integrated pest management, and one each on (1) site selection, soil fertility, sampling, and fertility management, (2) farm safety and health, (3) production and financial record keeping, and (4) USDA Farm Service Agency loan programs and application criteria.

b. Impact

Research: Some results of this work:

- Nutrition and physical activity lessons have been developed that incorporate teachings from an American Indian perspective.
- Materials on health care access as being provided to low literacy monolingual Spanish speaking Latin Americans in the Twin Cities.
- Basic bilingual health materials are being made available for use in English as a Second Language (ESL) classes to help people learn about both the health care system and health issues.

Extension:

Over 38 percent of eligible EPSDT (Early, Periodic Screening, Diagnosing, and Testing) families received necessary health care and screening services in one large suburban county, as a result of a joint Extension Service and Public Health intervention to address diverse cultural attitudes about health and healthcare. The educator estimated that every dollar spent on outreach and health screening will save $18 in future public healthcare costs.

Winona city police and officials credit Project FINE/Extension with the low incidence of hate crimes toward newcomer families in their city.

Four immigrant farm families have offered earnest money to buy 116 acres of farmland in Dakota County. Fourteen immigrant farmers who took the PPAT course passed the exam and received their private applicator's license.

c. Source of Federal Funding: Hatch and Smith-Lever 3b&c

d. Scope of Impact: State Specific

Key Theme: Farm Safety (JOINT)

MAES Plan of Work: GOAL 5

Extension Plan of Work: GOAL 5, Caring for Farm Families: Workplace Safety and Health, Safety Day Camps, Sun Safety for Outdoor Workers

a. Description

Agriculture is now ranked as the most dangerous industry in the U. S., based on occupational fatality data gathered by the National Safety Council. Farm-related accidents claim more than 750 lives and result in more than 120,000 disabling injuries each year. In addition, agricultural farm and industry workers experience high rates of certain occupational illnesses and diseases, such as skin cancer, respiratory illnesses, and dermatological conditions. According to national estimates, farm workplace injuries and deaths cost $4 billion annually. This figure does not include the value of lost time and productivity that can be overwhelmingly high for individual producers and small businesses. Farming is also considered to be one of the most stressful occupations in the U. S. because of the working conditions, combined with the tremendous amount of ambiguity, uncertainty, and variable economic conditions. The high level of stress contributes to many of the injuries and illnesses that farmers, family members, and farm workers experience and accidents with agricultural chemicals that have environmental consequences.

Last year, 24 farm fatalities were reported in Minnesota, down from 30 deaths reported in 2001. Even the Twin City metro newspapers carry news of terrible farm and agricultural industry accidents that result in death and/or dismemberment of farm family members and agricultural industry workers. The "good news" is that the incidence of such accidents is declining, thanks at least in part to Agricultural Safety and Health Education, including safety day camps for kids. Sun safety education is also a major effort with emphasizing the prevention of skin cancer, especially with youth. Using dermascan equipment at farm expos, county fairs, health fairs, and other events to show youth and adults the extent of skin damage due to prolonged sun exposure without protection has helped to create greater awareness of the risk of skin cancer in Minnesota and Iowa.

Research is focused on creatively engineering solutions in order to protect workers and property from harm by preventing most occupational injury and disease problems. For example, recent work has focused on the creation, prototype development, and testing of a computer-controlled, sensor-based, human presence detection system that can "see" people who are approaching or working too close to rotating machinery and other hazards. Another project involves in-depth investigation of fires that occur on grain combines.

Because of the growing diversity among farm workers, a need is being addressed to make existing agricultural safety and health guidelines and educational materials

culturally and linguistically appropriate for immigrant farm families, e.g., the Hmong, Hispanic, and Somalis in Minnesota.

b. Impact

Agricultural Safety and Health research and Extension programs have clear economic, as well as social and environmental benefits. The National Safety Council estimates that a workplace fatality costs an average of $900,000. An average disabling injury costs $25,000 in hospitalization, etc. In addition, the "downtime" while a farmer or worker is recuperating from an accident is estimated at more than $2,000 per day! Environmental benefits accrue from avoiding misapplications and spills of agricultural chemicals.

During 2001-02, Agricultural Safety and Health Programs in Minnesota directly reached more than 2,400 people, including many racial/ethnic minority people and immigrants. This total also included 330 health professionals who were involved in workshops. An additional 4,500 youth participated in safety day camps. The farm safety and health media campaign that gets underway at the beginning of the Minnesota State Fair in August and continues through National Farm Safety and Health Week in mid-September, resulted in placement of safety and health-related articles in at least 225 newspapers and magazines with total circulation in excess of 500,000. In addition, two major national radio interviews were conducted with total coverage of more than 350 local stations nationwide. This included 23 of the 25 radio markets in the U. S. that cover nearly 85 percent of the broadcast area. Extension programs received more than $172,000 in grants and in-kind contributions last year.

An investigation of nearly 9,000 combine fires has resulted in detailed fire prevention and control recommendations that have been presented to farm machinery and insurance industry representatives.

Educators involved in the "Sunsmart" Sun Safety Program, reported that 80 percent of program participants knew someone who had skin cancer and was undergoing treatment or had died as a result. 70 percent said they didn't regularly wear a hat or protective clothing at work and 90 percent did not take precautions, such as using a sunscreen, when outdoors for recreation. 60 percent took a dermascan skin damage test and 15 percent were encouraged to see a doctor for follow-up as a result of the test. All participants considered hats for skin protection from the sun that are currently on the market and voted on the one they would most likely buy. A local utility company provided sunscreen hats for all of their outdoor workers. Family members and stockholders were offered sunscreen hats at cost.

Youth were also taught lawn mower safety. Many do the mowing for their families or as a small business and risk the loss of fingers, toes, and even eyes.

c. Source of Funding: Hatch and Smith-Lever 3b&c

d. Scope of Impact: Multi-State

Report on Stakeholder Input Process

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

In 2002, the Minnesota Agricultural Experiment Station hosted two listening sessions for the general public, one in Cloquet, MN and one in Mankato, MN. These sessions were open to the public and were publicized on the local radio stations and the local newspapers. In addition, over 500 invitations were sent to local legislators, science teachers, librarians, and other constituents for each session. Deans or associate deans from University of Minnesota colleges receiving MAES funding were also in attendance as well as representatives from the University of Minnesota Extension Service. Notes from each of the sessions were distributed to the college administrators and comments were used in setting their research agendas.

Input cards were also designed and distributed at three "open house" events to gather information about MAES research interests and concerns from the public. Completed cards were forwarded to the appropriate college administrators for use in developing and bettering their college initiatives.

The MAES receives $1.6 million in recurring dollars from the state legislature each year for Rapid Agricultural Response research projects. In order 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 six out-state Research and Outreach Centers have advisory councils from which the College of Agricultural, Food and Environmental Sciences (COAFES) solicits advice on issues relating to how the centers can better serve communities. Also, COAFES holds stakeholder input sessions to receive input on the progress of priority initiatives as the result of a strategic planning process.

The College of Human Ecology (CHE) continues to hold dynamic and interactive meetings with representatives of departmental units. Some examples of active "listening" include the number of Advisory Council members involved in decision making: one member is on the nominating committee; another worked on our big 9/24/02 event; yet another is working on the Education planning committee. One member provided extensive feedback about our curriculum; two members worked on criteria for the Buckman Leadership program; one member helped define priority initiatives and another member is working on the strategic plan for CHE.

Campaign Human Ecology Kick-off was September 24. Attending were 300 stakeholders, faculty and staff. Following the program defining Human Ecology and our future, CHE asked for input from those attending. Several follow-ups

have continued. Plans are underway to travel statewide this year to tell the CHE story and get input from those attending.

CHE is creating strategies to develop relationships with decision makers and policymakers and to share relevant information. The dean is meeting with various legislators and commissioners. Eight legislative staff members visited the college in October and indicated that it was valuable. Similar events are planned for the future.

CHE meets with local employers to seek their input and assistance on how to best prepare our students. We have particularly strong relationships with Target Corporation and Best Buy. This year, 62 employers and more than 100 employees serve as mentors to our students.

The 50-member Department of Food Science and Nutrition Advisory Council advises the department on current issues related to food, nutrition, and health. The full group meets once during the year; the executive group meets three times a year. Issues this year included food safety and bioterrorism, whole grains, and chronic wasting disease.

CitySongs youth choir, the School of Social Work project that supports at-risk youth, promotes community involvement and enhances racial and ethnic relations in the Twin Cities. Although not specifically research-related, this provides a venue for interaction between University of Minnesota social science researchers and underserved and under-represented populations.

The Department of Wood and Paper Science, in the College of Natural Resources, has a strong record of interactions with the forest products industry and the paper industry. The department uses its "introduction to the profession" course as a vehicle to bring industry representatives to campus each week to describe their company and industry to students. Many other departmental classes take students on field trips to companies.

Of particular note in the Department of Wood and Paper Science, is a paper industry advisory group called the Paper Science and Engineering Council, consisting of over 20 companies. It meets formally twice per year at meetings consisting of both presentations by students, faculty, and staff; followed by discussion periods in which the council provides advice on departmental teaching and research activities. Council members are invited to the annual department scholarship banquet to interact with students, parents, faculty, and staff; and to present scholarship certificates. Input from the Council is used to help guide the research agenda, curriculum decisions and criteria for scholarship awards.

The Department of Forest Resources obtains stakeholder input in several ways: (1) from members of its several University/industry/government cooperatives (Aspen/Larch Genetics Cooperative, Minnesota Tree Improvement Cooperative,

and Cooperative Ecosystems Studies Unit; (2) from specific stakeholder involvement in research and outreach proposals and projects or their review; (3) from participation of faculty in Regional Sustainable Partnerships, (4) from attendance at or participation in professional society and continuing and other education programs (including increasing contact with Native American tribal programs in Minnesota); (5) interaction with citizen groups on issues related to faculty presentations; (6) and through a regular set of personal contacts with industry, government, legislative, and alumni leaders in Minnesota and nationally, these contacts being made primarily by the Department head. This input shapes departmental discussion, research, education, and extension priorities, and funding allocations in these areas in support of priorities.

The Department of Fisheries, Wildlife, and Conservation Biology receives and uses stakeholder input in several ways. First, they interact with a wide range of stakeholders through a grants and contract process, understanding their needs and generating proposals to meet those needs. Second, the Minnesota Cooperative Fish and Wildlife Research Unit has a formal board of stakeholders that meets regularly to discuss completed, ongoing and planned work. Third, many faculty members are active within the university on Senate and Administrative committees. Fourth, one faculty member chairs the Governor's Oversight Committee for the Department of Natural Resources and is president of an 8,500 member of one of the professional societies in our field. Fifth, many members of the faculty are active in their professional societies and those societies uniformly include professional as well as academic members. Sixth, several members of our faculty are active leaders in Extension programming, working with local stakeholders as well as with Extension administration to ensure that our work is meaningful to stakeholders. Finally, faculty are engaged in an analysis of the need for a Master Naturalist program that would be the cornerstone of our Extension programming. That analysis is based both in stakeholder analysis and in analysis of other such programs.

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 publications, mailing lists for constituents, 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 the Colleges of Agricultural, Food and Environmental Sciences; Human Ecology; Natural Resources; Biological Sciences; and Veterinary Medicine met as an Experiment Station Executive Council every other month to identify research priorities, set research policies, plan programs and discuss stakeholder input for inclusion in policy and

planning decisions.

On the college level, the input is being used in strategic planning processes for priority initiative development and implementation, and research agendas.

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 Design, Housing and Apparel, in the College of Human Ecology, underwent a CSREES program review in 2002.

The department of Food, Science and Nutrition, administered jointly in the College of Human Ecology and the College of Agricultural, Food and Environmental Sciences, will be undergoing a CSREES 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 137 multi-state projects and committees. These included NC (36), NCA (14), NCR (35), NCS (1), NCT (4), NE (12), NEC (1), NRSP (3), S (11), SERA (1), SRDC (1), W (13), and WCC (5). CRIS progress reports have been filed to document Minnesota's participation in the projects. Participation in these projects by our faculty provided the opportunity to share resources and expertise across the North Central Region and across the nation.

  The College of Agricultural, Food and Environmental Sciences and the College of Veterinary Medicine co-sponsored two national workshops: a CSREES grantsmanship workshop in September, 2002; and a National Science Foundation grants workshop in February, 2003.

  On February, 20-21, 2003, the College of Agricultural, Food and Environmental Sciences at the University of Minnesota and the College of Agriculture at Iowa State University co-hosted a dairy research conference attended by dairy research and extension faculty from University of Illinois, North Dakota State University, South Dakota State University, Michigan Station University, Iowa State University and the University of Minnesota.

  The College of Agricultural, Food and Environmental Sciences has been awarded a grant from the W.K. Kellogg Foundation to partner with South Dakota State University, Turtle Mountain Community College in Belcourt, ND and White Earth Tribal and community College in Mahnomen, MN to engage in planning a Native American Branch Experiment Station.

  The Center for Animal Health and Food Safety, in the College of Veterinary Medicine, plays a leadership role in assuring food safety from the farm to the consumer. It does this regionally and nationally through: aggressive risk communication; applied research; integrated animal and public health surveillance; expanded educational programs; facilitation of creative prevention and quality assurance strategies involving producers, processors, distributors, retailers, food service and consumers

  The Center brings an unparalleled array of expertise to address this critical public health, economic and social issue. The University of Minnesota is unique in having Colleges of Agricultural, Food and Environmental Sciences, Veterinary Medicine, and Medicine plus Schools of Public Health and Business all co-located on the Twin Cities campus. The center is thus able to pull together

talented University faculty involved in human and veterinary medicine, public health, agriculture, nutrition, economics, engineering and business. Center faculty also actively collaborate with professional organizations, industry and commodity groups, consumer representatives, and state and federal public health agencies.

- **Success of joint research and extension activities**

  The MN Agricultural Experiment Station is governed by an Executive Council. This council is comprised of the deans and associate deans for research in the colleges of Agricultural, Food and Environmental Sciences; the College of Human Ecology, the College of Biological Sciences; the College of Veterinary Medicine; and the College of 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. This council oversees budget and policy decisions and establishes research priorities.

  With funding from the Minnesota Legislature, the MN Agricultural Experiment Station manages a Rapid Agricultural Response Fund for emerging and/or emergency agricultural issues in the state. To be eligible for this funding, all research project proposals must outline an extension communication plan to disseminate the research results to the public.

  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 the MN Agricultural Experiment Station and the University of Minnesota Extension Service are members of the regional committees and are involved in collaborative work addressing issues identified by the regional committees.

  The University of Minnesota has six Research and Outreach Centers located at Grand Rapids, Crookston, Morris, Lamberton and Waseca, Minnesota. Extension and AES personnel with joint appointments are located at each center. The centers serve as gateways to the University of Minnesota. Extension and research faculty and staff participate in field days on multiple topics related to agricultural research and outreach to social and policy issues related to supporting vital rural communities. The centers provide ideal venues for addressing community concerns facing rural Minnesota while continuing their mandate to deliver research based results on agricultural and natural resource issues via the University of Minnesota Extension Service. Seamless collaboration of Extension and research personnel at the centers has been crucial to the effectiveness of the centers.

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 dollars expended for these five themes totaled $90,583, which is 36 percent of the total Hatch dollars reported in this report ($250,702).

The actual dollars expended in FY 2002 for all Hatch projects integrated with Extension programs are documented on the attached 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 outreach components (attached). This listing provides further evidence of the integrative efforts for federal funding at the University of Minnesota.

AREERA
FY 2001/2002 EXPENDITURES

Goal / Theme	Hatch	MRF	McIntire Stennis	Animal Health	Special / Competitive	State Funds	Other Federal	Other NonFederal	Total Funds
Goal 1									
Agricultural Profitability	54,744	49,796	0	0	16,015	434,327	55,854	257,265	868,012
Animal Health	16,587	1,484	0	0	0	106,524	0	0	124,595
Biotechnology	19,200	33,252	0	0	0	401,782	368,093	133,256	955,595
Ornamental/Green Agriculture	0	0	0	0	0	435,549	72,157	62,783	570,498
Plant Health	25,078	0	0	0	60,218	411,890	92,166	357,557	946,921
Risk Management	44,172	0	0	0	416,855	97,508	132,065	0	690,604
Total Goal 1	**159,781**	**84,532**	**0**	**0**	**493,088**	**1,887,580**	**720,335**	**810,861**	**4,156,225**
Goal 2									
Foodborne Illness/Food Safety	17,801	0	0	0	0	68,481	0	1,721	88,004
Total Goal 2	**17,801**	**0**	**0**	**0**	**0**	**68,481**	**0**	**1,721**	**88,004**
Goal 3									
Human Health	8,767	0	0	0	0	182,872	78,277	33,881	303,801
Total Goal 3	**8,767**	**0**	**0**	**0**	**0**	**182,872**	**78,277**	**33,881**	**303,801**
Goal 4									
Drainage	26,709	722	0	0	754,081	323,028	53,577	152,383	1,310,513
Forest Resource Management	0	0	3,539	0	0	286,499	1,141,688	547,583	1,979,340
Water Quality	0	0	0	0	0	69,380	0	427,043	496,433
Total Goal 4	**26,709**	**722**	**3,539**	**0**	**754,081**	**678,907**	**1,195,265**	**1,127,009**	**3,786,286**
Goal 5									
Farm Safety	21,834	0	0	0	0	27,630	252,525	0	301,992
Multicultural and Diversity Issues	15,810	0	0	0	0	127,440	0	83,832	227,086
Total Goal 5	**37,644**	**0**	**0**	**0**	**0**	**155,070**	**252,525**	**83,832**	**529,078**
Grand Total	**250,702**	**85,254**	**3,539**	**0**	**1,247,169**	**2,972,910**	**2,246,402**	**2,057,304**	**8,863,395**

AREERA
FY 2001/2002 DETAIL OF EXPENDITURES

Goal / Theme	Project	Hatch	MRF	McIntire Stennis	Animal Health	Sp/Comp Grant	State Funds	Other Federal	Other Non-Fed	Total Funds	FTE's
Goal 1											
Agricultural Profitability	13-029	0	0	0	0	0	0	0	0	0	0.7
	13-054	0	0	0	0	0	74,889	0	72,577	147,468	2.0
	14-034	25,566	0	0	0	16,015	40,621	0	1,817	84,020	1.0
	14-055	25,803	1,382	0	0	0	45,137	0	0	72,323	1.9
	17-023	0	0	0	0	0	96,691	55,854	50,773	203,321	3.4
	25-064	1,794	48,414	0	0	0	99,858	0	4,577	154,645	2.4
	25-085	1,581	0	0	0	0	77,131	0	127,521	206,236	9.8
		54,744	**49,796**	**0**	**0**	**16,015**	**434,327**	**55,854**	**257,265**	**868,012**	**21.2**
Animal Health	12-076	16,587	0	0	0	0	32,855	0	0	49,442	0.9
	60-009	0	0	0	0	0	1,549	0	0	1,549	0.3
	62-R02	0	0	0	0	0	87	0	0	87	0.0
	63-063	0	1,484	0	0	0	0	0	0	1,484	0.0
	63-R01	0	0	0	0	0	72,033	0	0	72,033	0.0
		16,587	**1,484**	**0**	**0**	**0**	**106,524**	**0**	**0**	**124,595**	**1.2**
Biotechnology	13-053	0	0	0	0	0	189,950	188,797	15,182	393,935	6.9
	16-028	0	33,252	0	0	0	55,411	0	1,080	89,744	10.6
	22-015	19,200	0	0	0	0	103,666	179,296	116,994	419,161	5.7
	22-020	0	0	0	0	0	0	0	0	0	0.0
	62-R01	0	0	0	0	0	52,755	0	0	52,755	0.0
		19,200	**33,252**	**0**	**0**	**0**	**401,782**	**368,093**	**133,256**	**955,595**	**23.2**
Ornamental/Green Agriculture	13-035	0	0	0	0	0	163,790	53,909	5,926	223,628	3.3
	21-049	0	0	0	0	0	103,754	0	2,217	105,973	3.5
	21-060	0	0	0	0	0	93,508	18,248	6,172	117,929	1.4
	22-025	0	0	0	0	0	74,497	0	48,468	122,968	3.8
		0	**0**	**0**	**0**	**0**	**435,549**	**72,157**	**62,783**	**570,498**	**12.0**
Plant Health	17-042	16,390	0	0	0	0	106,552	7,334	66,986	197,264	2.6
	17-049	5,771	0	0	0	15,939	70,855	25,042	186,564	304,176	6.1
	17-G12	0	0	0	0	0	0	0	0	0	0.4
	21-019	0	0	0	0	44,279	93,137	59,790	104,007	301,217	7.2
	21-R01	0	0	0	0	0	114,736	0	0	114,736	0.0
	22-026	2,917	0	0	0	0	26,610	0	0	29,527	0.9
	22-R01	0	0	0	0	0	0	0	0		0.0

Goal / Theme	Project	Hatch	MRF	McIntire Stennis	Animal Health	Sp/Comp Grant	State Funds	Other Federal	Other Non-Fed	Total Funds	FTE's
		25,078	**0**	**0**	**0**	**60,218**	**411,890**	**92,166**	**357,557**	**946,921**	**17.2**
Risk Management	14-027	0	0	0	0	0	35,437	0	0	35,437	0.2
	14-040	44,172	0	0	0	0	62,071	25,599	0	131,843	1.7
	14-G05	0	0	0	0	416,855	0	106,466	0	523,323	2.4
		44,172	**0**	**0**	**0**	**416,855**	**97,508**	**132,065**	**0**	**690,604**	**4.3**
Goal 1 Total		**159,781**	**84,532**	**0**	**0**	**493,088**	**1,887,580**	**720,335**	**810,861**	**4,156,225**	**79.1**
Goal 2											
Foodborne Illness/Food Safety	18-039	0	0	0	0	0	0	0	0		0.0
	18-054	17,801	0	0	0	0	68,481	0	1,721	88,004	3.0
		17,801	**0**	**0**	**0**	**0**	**68,481**	**0**	**1,721**	**88,004**	**3.0**
Goal 2 Total		**17,801**	**0**	**0**	**0**	**0**	**68,481**	**0**	**1,721**	**88,004**	**3.0**
Goal 3											
Human Health	18-084	126	0	0	0	0	83,922	0	24,182	108,231	1.5
	54-026	8,443	0	0	0	0	24,578	0	60	33,082	1.4
	54-034	198	0	0	0	0	74,372	78,277	9,639	162,488	2.3
	54-058	0	0	0	0	0	0	0	0		0.0
	54-G05	0	0	0	0	0	0	0	0		0.0
		8,767	**0**	**0**	**0**	**0**	**182,872**	**78,277**	**33,881**	**303,801**	**5.2**
Goal 3 Total		**8,767**	**0**	**0**	**0**	**0**	**182,872**	**78,277**	**33,881**	**303,801**	**5.2**
Goal 4											
Drainage	12-040	15,746	0	0	0	0	62,241	53,577	15,615	147,181	4.2
	25-020	10,963	0	0	0	754,081	221,880	0	61,045	1,047,977	8.9
	25-035	0	722	0	0	0	38,907	0	75,723	115,354	3.5
		26,709	**722**	**0**	**0**	**754,081**	**323,028**	**53,577**	**152,383**	**1,310,513**	**16.6**
Forest Resource Management	40-015	0	0	0	0	0	68,343	0	69,557	137,903	2.9
	42-020	0	0	3,539	0	0	9,283	1,141,688	310,665	1,465,198	27.1
	42-039	0	0	0	0	0	0	0	0	0	0.8
	42-070	0	0	0	0	0	208,873	0	167,361	376,240	7.6
		0	**0**	**3,539**	**0**	**0**	**286,499**	**1,141,688**	**547,583**	**1,979,340**	**38.4**
Water Quality	02-R03	0	0	0	0	0	32,324	0	0	32,324	0.0

Goal / Theme	Project	Hatch	MRF	McIntire Stennis	Animal Health	Sp/Comp Grant	State Funds	Other Federal	Other Non-Fed	Total Funds	FTE's
Water Quality	25-046	0	0	0	0	0	37,056	0	427,043	464,109	12.2
	25-055	0	0	0	0	0	0	0	0		0.0
		0	**0**	**0**	**0**	**0**	**69,380**	**0**	**427,043**	**496,433**	**12.2**
Goal 4 Total		**26,709**	**722**	**3,539**	**0**	**754,081**	**678,907**	**1,195,265**	**1,127,009**	**3,786,286**	**67.2**
Goal 5											
Farm Safety	12-027	21,834	0	0	0	0	27,630	252,525	0	301,992	3.8
		21,834	**0**	**0**	**0**	**0**	**27,630**	**252,525**	**0**	**301,992**	**3.8**
Multicultural and Diversity Issues	52-084	0	0	0	0	0	11,488	0	0	11,488	0.4
	54-029	550	0	0	0	0	53,584	0	521	54,656	1.0
	54-070	15,260	0	0	0	0	62,368	0	83,311	160,942	2.7
		15,810	**0**	**0**	**0**	**0**	**127,440**	**0**	**83,832**	**227,086**	**4.1**
Goal 5 Total		**37,644**	**0**	**0**	**0**	**0**	**155,070**	**252,525**	**83,832**	**529,078**	**7.9**
Grand Total		**250,702**	**85,254**	**3,539**	**0**	**1,247,169**	**2,972,910**	**2,246,402**	**2,057,304**	**8,863,395**	**162.4**

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		
Goal 2.	291,982	379,236	137,018		
Goal 3.	88,621	98,731	52,469		
Goal 4.	508,025	474,188	340,191		
Goal 5.	189,992	295,702	180,558		
Total	$2,587,830	$4,284,038	$2,819,595		

Form CSREES-REPT (2/01)

_____ _____
Director **Date**

FY 2001 / 2002 Financial Data
Integrated Research and Extension Activities
University of Minnesota
Agricultural Experiment Station
Minnesota Extension Service
Plan of Work Components

EXTENSION PROGRAM	RESEARCH PROJECT		HATCH $
Goal 1. An Agricultural System That is Highly Competitive in the Global Economy			
Ag. Prod. & Farm Bus. Mgmt.	12-030	IMPROVEMENT OF THERMAL AND ALTERNATIVE PROCESSES FOR FOODS	4,067
	12-076	ENVIRONMENTAL AND AIR QUALITY ASSESSMENT AND CONTROL OF LIVESTOCK	16,587
	12-092	ADVANCED SENSING, PROCESSING AND CONTROL TECHNOLOGY FOR BIOLOGICAL,	13,982
	13-067	DECISION MAKING FOR DIVERSIFIED CROPPING SYSTEMS	3,008
	14-022	ENHANCING THE FINANCIAL VIABILITY OF MINNESOTA FAMILY FARMS	32,308
	14-034	PROFITABILITY AND ADOPTION OF NEW TECHNOLOGY AND IMPLICATIONS FOR	25,566
	14-035	MANAGEMENT INFORMATION SYSTEMS FOR FIRMS IN THE FOOD SYSTEM	53,701
	14-045	PRIVATE STRATEGIES, PUBLIC POLICIES, AND FOOD SYSTEM PERFORMANCE	61,423
	14-056	FINANCING AGRICULTURE AND RURAL AMERICA: ISSUES OF POLICY, STRUCTURE AND	18,223
	14-057	AN ECONOMIC ANALYSIS OF U.S. LIVESTOCK SECTOR FACING DEMAND AND SUPPLY	34,509
	18-018	IMPROVED STABILITY OF DRY FOOD FLAVORINGS	25,387
	18-024	PHYSICO CHEMICAL PROPERTIES OF DAIRY MACROMOLECULES IN FOOD SYSTEMS	13,722
	18-055	IN VIVO REGULATORY SYSTEMS IN LACTIC ACID BACTERIA: BACTERIOPHAGE	16,107
	18-062	APPLICATION OF GENETIC ENGINEERING TECHNIQUES FOR DAIRY STARTER CULTURE	49,343
	18-065	STRUCTURE/FUNCTION RELATIONSHIPS IN CEREAL GRAINS AND THEIR INFLUENCE ON	38
	54-057	FACTORS AFFECTING FOOD ACCEPTABILITY AND METHODS OF ASSESSMENT	18,515
Animal Prod. & Mgmt Strategies	03-016	METHODS TO INCREASE REPRODUCTIVE EFFICIENCY IN CATTLE	1,964
	05-025	MANAGEMENT SYSTEMS FOR IMPROVED DECISION MAKING AND PROFITABILITY OF	1,410
	13-026	FORAGE PROTEIN CHARACTERIZATION AND UTILIZATION FOR CATTLE	56,916
	14-040	ECONOMIC ANALYSIS OF LIVESTOCK INDUSTRY MARKETING, PRICES, PRODUCTION	44,172
	14-055	IMPACTS OF STRUCTURAL CHANGE IN THE DAIRY INDUSTRY	27,185
	16-017	ADVANCED TECHNOLOGIES FOR THE GENETIC IMPROVEMENT OF POULTRY	45,446
	16-018	BIOPHYSICAL MODELS FOR POULTRY PRODUCTION SYSTEMS	
	16-023	IDENTIFICATION OF A RECIPIENT GENOME FOR THE GENERATION OF A CHICKEN	35,949
	16-024	NUTRITIONAL DETERMINANTS OF CARDIOVASCULAR DISEASE	
	16-028	GENETIC ENHANCEMENT OF HEALTH AND SURVIVAL FOR DAIRY CATTLE	33,252
	16-033	WATER QUALITY ISSUES IN POULTRY PRODUCTION AND PROCESSING	
	16-034	IMPROVING TURKEY PRODUCTION PERFORMANCE THROUGH NUTRITION AND	109,783
	16-042	GENETIC IMPROVEMENT OF CATTLE USING MOLECULAR GENETIC INFORMATION	595
	16-044	FACTORS AFFECTING BIOLOGICAL AND ECONOMIC EFFICIENCY OF THE BEEF CATTLE	
	16-046	REGULATION OF NUTRIENT USE IN FOOD PRODUCING ANIMALS	34,164
	16-050	METABOLIC RELATIONSHIPS IN SUPPLY OF NUTRIENTS FOR LACTATING COWS	30,451
	16-064	EVALUATION OF NEW NUTRITIONAL TECHNOLOGIES FOR SITUATION DEPENDENT DIET	84,738
	16-080	THE EFFECT OF GROWTH FACTORS ON THE PROCESSES OF SKELETAL MUSCLE GROWTH	26,670
	16-084	MOLECULAR MECHANISMS REGULATING SKELETAL MUSCLE GROWTH AND	35,019

EXTENSION PROGRAM	RESEARCH PROJECT		HATCH $
Animal Prod. & Mgmt Strategies	16-087	REPRODUCTIVE PERFORMANCE OF TURKEYS	230,323
	17-056	SOURCES, DISPERSAL AND MANAGEMENT OF STABLE FLIES ON GRAZING BEEF AND	1,049
	60-015	PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME (PRRS): MECHANISMS OF	27,584
	63-032	AVIAN RESPIRATORY DISEASES: PATHOGENESIS, SURVEILLANCE, DIAGNOSIS AND	1,818
	63-036	EVOLVING PATHOGENS, TARGETED SEQUENCES, AND STRATEGIES FOR CONTROL OF	31,708
	63-056	NATIONAL ANIMAL GENOME RESEARCH PROGRAM	21,729
	63-060	CONTROL OF ANIMAL PARASITES IN SUSTAINABLE AGRICULTURAL SYSTEMS	13,298
	63-063	POSITIONAL AND FUNCTIONAL IDENTIFICATION OF ECONOMICALLY IMPORTANT	1,484
Crop Prod. & Mgmt. Strategies	01-022	HOST PLANT CONTROL RESISTANCE TO AND BEST MANAGEMENT PRACTICES FOR	
	12-028	DEVELOPMENT AND TESTING OF DRY FERTILIZER SENSORS AND MACHINERY FOR	9,310
	13-019	OAT BREEDING AND GENETICS	46,317
	13-020	CHARACTERIZING WEED POPULATION VARIABILITY FOR IMPROVED WEED	113,455
	13-022	MOLECULAR CYTOGENETICS IN PLANT IMPROVEMENT	48,357
	13-030	BARLEY BREEDING AND GENETICS	48,045
	13-033	LEGUMES IN CROPPING SYSTEMS	57,929
	17-032	ECOLOGY AND MANAGEMENT OF EUROPEAN CORN BORER AND OTHER	46,015
	17-034	MANAGEMENT STRATEGIES FOR EUROPEAN CORN BORER, CORN ROOTWORMS, AND	15,018
	17-042	POTATO INSECTS: BIOLOGICAL AND CULTURAL CONTROL	16,390
	17-049	MANAGEMENT OF INSECTS AND INSECT VECTORS OF PLANT PATHOGENS IN POTATO	5,771
	17-066	BIORATIONAL METHODS FOR INSECT PEST MANAGEMENT (IPM): BIORATIONAL AND	
	17-067	DEVELOPMENT OF PEST MANAGEMENT STRATEGIES FOR FORAGE ALFALFA	13,937
	21-049	INCREASING PRODUCTION EFFICIENCY AND LONG TERM HEALTH OF NURSERY GROWN	
	22-015	GENOMICS OF CYST NEMATODE RESISTANCE IN SOYBEAN	19,200
	22-020	DISEASE RESISTANCE IN SMALL GRAIN CEREAL CROPS AND THEIR WILD RELATIVES	
	22-026	MANAGEMENT AND CONTROL OF DISEASES OF SOYBEANS	2,917
	22-079	IDENTIFICATION, CHARACTERIZATION AND BIOLOGY OF PLANT PARARETROVIRUSES	23,554
	70-030	MOLECULAR ANALYSIS OF THE VIRULENCE GENES OF AGROBACTERIUM TUMEFACIENS	33,453
	70-042	ENZYMOLOGY OF FORAGE PROCESSING	516
Food Crops	21-019	POTATO BREEDING AND GENETICS	
Green Industry	21-050	BREEDING AND GENETICS OF FLORICULTURAL CROPS: OLD, NEW CROP DEVELOPMENT,	35,041
	21-054	THE BIOLOGY AND UTILIZATION OF TURFGRASSES	33,431
	21-055	BREEDING, EVALUATION & SELECTION OF HARDY LANDSCAPE PLANTS	108,462
	21-064	MOLECULAR ANALYSIS OF FLORAL GENE EXPRESSION	32,072
	21-073	FREEZE DAMAGE AND PROTECTION OF HORTICULTURAL SPECIES	207
	21-082	PLANT AND ROOT RESPONSE TO ENVIRONMENTAL STRESS	17,025
Int. Ag. Competitiveness	14-064	ENVIRONMENTAL AND TRADE COMPETITIVENESS ISSUES IN AGRICULTURE	48,105
	14-068	INTERNATIONAL ASPECTS OF INTELLECTUAL PROPERTY RIGHTS IN AGRICULTURE	9,570
Value-Added Agriculture	14-046	COMPETITIVENESS AND VALUE-ADDED MARKETS IN THE U.S. GRAIN AND OILSEED	42,052
	18-023	FUNCTIONAL FOODS: FIBER-AND ANTIOXIDANT-ENRICHED FOODS	17
	Total Hatch Dollars - Goal 1.		**$ 2,109,359**

Goal 2. A Safe and Secure Food and

	12-020	MARKETING AND DELIVERY OF QUALITY CEREALS AND OILSEEDS	9,787

EXTENSION PROGRAM		RESEARCH PROJECT	HATCH $
	18-037	CHARACTERIZATION AND CONTROL OF THE ACID RESISTANCE OF	
	18-039	ENHANCING FOOD SAFETY THROUGH CONTROL OF FOOD-BORNE DISEASE AGENTS	
	18-040	THE IMPACT OF CATTLE DIET ON THE FECAL SHEDDING OF FOOD-BORNE PATHOGENS	18,245
	18-054	ELIMINATION OF ESCHERICHIA COLI AND SALMONELLAE FROM READY TO CONSUME	17,801
	18-072	PHYSICAL CHEMISTRY OF FOODS: RELATIONSHIPS OF WATER ACTIVITY,	28,283
	18-074	APPLICATION OF CHEMILUMINESCENT ANTIBIOTICS AS PLATFORM TECHNOLOGY FOR	16,123
	21-027	POSTHARVEST PHYSIOLOGY OF FRUITS	
	21-028	CHANGES IN QUALITY OF HORTICULTURAL CROPS DURING GROWTH AND STORAGE	45,583
	22-043	MYCOTOXINS IN CEREAL GRAINS	1,196
	Total Hatch Dollars - Goal 2.		**$ 137,018**

Goal 3. A Healthy, Well-Nourished Population

	18-045	MODIFYING MILK FAT COMPOSITION FOR IMPROVED MANUFACTURING QUALITIES	709
	18-084	STUDIES ON THE SECONDARY OXIDATION OF VARIOUS LIPIDS AND EDIBLE FATS IN	126
	54-026	IDENTIFICATION OF FACTORS PREDICTING CONSUMPTION OF SELECTED DIETARY	8,443
	54-030	SYSTEMS ANALYSES OF THE RELATIONSHIPS OF AGRICULTURE AND FOOD SYSTEMS TO	514
	54-034	DIETARY REGULATION OF SEX HORMONE SYNTHESIS AND METABOLISM	198
	54-048	QUANTIFICATION OF FATTY ACID AND TRIGLYCERIDE FLUX IN FASTED AND FED	501
	54-059	A MULTICULTURAL INVESTIGATION OF FOOD AS MEDICINE	6,938
	54-060	ROLE OF N-3/N-6 POLYUNSATURATED FATTY ACIDS IN HEALTH MAINTENANCE	16,666
	54-064	DEFINING A DESIRABLE DIETARY FIBER INTAKE	18,374
	Total Hatch Dollars - Goal 3.		**$ 52,469**

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

Animal Waste Management	12-084	ANIMAL MANURE AND WASTE UTILIZATION, TREATMENT AND NUISANCE AVOIDANCE	51,254
Environmental Learning/Leadership			
Fisheries & Wildlife Habitat Mgmt.	41-033	EVOLUTIONARY GAMES AND MODELING CONSERVATION: CONSEQUENCES OF SPACE	
	41-074	TROPHIC RELATIONS IN FRESHWATER SYSTEMS	
	41-078	INFLUENCE OF FISHERIES MANAGEMENT PRACTICES ON GENETIC RESOURCES OF FISH	0
	41-086	RELATIONSHIPS BETWEEN WILD UNGULATES & NATURAL VEGETATION: ECOLOGICAL	0
Imp. Water Quality in MN River			
Inc. & Main. Diversity in Ag. Syst.			
Soil Nutrient & Water Management	12-040	INVESTIGATING DRAINAGE DESIGN AND MANAGEMENT ALTERNATIVES FOR MEETING	15,746
	14-089	EXAMINING POLICIES AND INSTITUTIONS FOR LAND AND WATER RESOURCE	25,743
	25-022	ASSESSING NITROGEN MINERALIZATION AND OTHER DIAGNOSTIC CRITERIA TO REFINE	476
	25-034	TILLAGE AND NUTRIENT SOURCE INTERACTIONS ON NON-POINT SOURCE POLLUTION	2,036
	25-083	BIOGEOCHEMISTRY AND ECOLOGICAL RISK MANAGEMENT OF TRACE CHEMICAL	10,947
	25-084	IMPROVING PLANT NUTRIENT USE EFFICIENCY	2,136
Sust. Nat. Res Mgmt & Steward	17-068	INTERACTIONS AMONG BARK BEETLES, PATHOGENS, AND CONIFERS IN NORTH	919
	22-069	BIOLOGY, CONTROL, AND BIOTECHNOLOGICAL USES OF FOREST MICROBES	52,120
	25-019	REDUCING THE POTENTIAL FOR ENVIRONMENTAL CONTAMINATION BY PESTICIDES	26,576
	25-020	LAND RESOURCE ASSESSMENT, INTERPRETATION, AND DELIVERY FOR MINNESOTA	10,963

EXTENSION PROGRAM	RESEARCH PROJECT		HATCH $
Sust. Nat. Res Mgmt & Steward	42-037	REMOTE SENSING OF LAND, VEGETATION, AND WATER RESOURCES	0
	42-074	NET PRIMARY PRODUCTIVITY AND CARBON SEQUESTRATION POTENTIAL OF LAKE	0
	43-054	ASSESSMENT OF CHANGING RAW MATERIAL NEEDS AND LIFE CYCLE ENVIRONMENTAL	16,363
	43-068	LIGNIN BIOSYNTHESIS, BIODEGRADATION AND DERIVATIVE PLASTICS	18,004
Sustainable Agriculture	05-024	MANAGING PLANT-PARASITIC NEMATODES IN SUSTAINABLE AGRICULTURE WITH	635
	14-029	DECISION MAKING FOR AGRICULTURAL FIRMS CONSIDERING RISK AND THE	13,600
	14-073	U.S. AGRICULTURAL AND ENVIRONMENTAL POLICY	29,992
	22-074	ATMOSPHERIC DEPOSITION: AIR POLLUTANTS AND THEIR EFFECTS ON CROPS	11,751
	25-035	MANAGEMENT OF ERODED SOILS FOR ENHANCEMENT OF PRODUCTIVITY AND	722
	25-064	IMPACT CLIMATE AND SOILS ON CROP SELECTION AND MANAGEMENT	50,208
	Total Hatch Dollars - Goal 4.		**$ 340,191**

Goal 5. Enhanced Economic Opportunity and Quality of Life

	12-027	INJURY PREVENTION AND HEALTH PROMOTION RESEARCH FOR PRODUCTION	21,834
	54-029	EXAMINATION OF NUTRITIONAL STATUS AND DIETARY BEHAVIOR FOR MINORITY	550
4-H/Youth Development	52-040	FAMILY SYSTEMS AND FAMILY REALITIES	7,103
Fin. & Providing Public Services	13-040	COMMODITIES, CONSUMERS, AND COMMUNITIES: LOCAL FOOD SYSTEMS IN A	819
Ind. & Family Fin. Mgmt.	14-094	RURAL LABOR MARKET BEHAVIOR AND OUTCOMES: THE ROLE OF WORK SUPPORT	10,752
	52-077	SELF EMPLOYMENT AMONG THE UNITED STATES HISPANIC HOUSEHOLDERS	7,582
	52-080	ASSET ACCUMULATION FOR LOW-INCOME WORKING FAMILIES	
Personal & Family Health	14-044	FOOD DEMAND, NUTRITION AND CONSUMER BEHAVIOR	63,687
	52-054	DECISION-MAKING INTEGRAL TO RELATIONSHIP TRANSITIONS IN FAMILIES	6,691
	52-055	FAMILY ECONOMIC WELL-BEING: TRANSITIONS FOR FAMILIES	8,584
	52-066	INTERGENERATIONAL RELATIONSHIPS IN SOUTHEAST ASIAN REFUGEE FAMILIES	2,132
	52-073	FAMILY BUSINESS: WORK AND FAMILY INTEGRATION	2,802
	52-078	RURAL LOW-INCOME FAMILIES: TRACKING WELL-BEING AND FUNCTIONING IN THE	1,134
	53-073	HOUSING, NEIGHBORHOOD, AND COMMUNITY ENVIRONMENTS OF LOW-RESOURCE	6,011
	55-035	VITAL INVOLVEMENT PRACTICE: PROMOTING LIFE STRENGTHS AMONG DIVERSE	6,826
	55-036	SOCIAL SUPPORT, SOCIAL NETWORKS, AND FAMILY VIOLENCE	143
	55-047	PROFESSIONALISM AMONG SOCIAL WORKERS: LINKAGES AMONG FAMILY, SCHOOL,	9,139
	55-048	PATTERNS OF ADAPTATION AND ACCEPTANCE OF HISPANICS IN AMERICAN	14,390
Tourism Dev.	53-065	DEVELOPMENT OF AN INTERIOR MATERIAL RATING SYSTEM FOR ENVIRONMENTAL	5,484
Urban and Rural Landscapes	42-046	BENEFITS-BASED MANAGEMENT: ASSESSING AND MANAGING FOR PUBLIC, PRIVATE,	0
	52-049	FAMILY BOUNDARY AMBIGUITY IN ALZHEIMER'S DISEASE AND OTHER SITUATIONS OF	4,895
	Total Hatch Dollars - Goal 5.		**$ 180,558**
	Total Hatch Dollars - All Goals		**$2,819,595**

FY 2002 FACULTY WITH JOINT APPOINTMENTS (RESEARCH/EXTENSION) MINNESOTA AGRICULTURAL EXPERIMENT STATION UNIVERSITY OF MINNESOTA

Department	% Research	% Extension	% Teaching
NWROC - CROOKSTON			
Marx,George Donald	82%	18%	0%
Macrae,Ian Vance	41%	40%	0%
Toubia-Rahme,Hala M	47%	33%	0%
Wiersma,Jochum Jan	44%	41%	0%
WCROC - MORRIS			
Johnston,Lee Jay	80%	20%	0%
Rudstrom,Margaretha Ve	67%	33%	0%
NCROC - GRAND RAPIDS			
Nyvall,Robert F	80%	20%	0%
Lamb,Graham Clifford	77%	23%	0%
SWROC - WASECA			
Fritz,Vincent A	70%	30%	0%
Baidoo,Samuel Kofi	80%	20%	0%
Zhu,Jun	80%	20%	0%
BIOSYSTEMS AND AGRICULTURAL ENGINEERING			
Jacobson,Larry Dean	25%	75%	0%
Janni,Kevin A	55%	45%	0%
Wilcke,William F	25%	75%	0%
Shutske,John M	25%	75%	0%
Sands, Gary R	35%	65%	0%
AGRONOMY AND PLANT GENETICS			
Becker,Roger Lee	25%	75%	0%
Durgan,Beverly	26%	71%	3%
Gunsolus,Jeffrey	30%	70%	0%
Hicks,Dale	8%	92%	0%
Peterson,Paul	25%	75%	0%
APPLIED ECONOMICS			
Levins,Richard Allen	10%	72%	18%
Morse,George Wilson	20%	80%	0%
Olson,Kent D	35%	25%	40%
Parliament,Claudia	20%	40%	40%

Buhr,Brian L	40%	40%	20%
Fruin,Jeremiah E	50%	50%	0%
Lazarus,William Frankl	20%	80%	0%
Stevens,Stanley C	15%	76%	9%
Stinson,Thomas F	46%	45%	9%
Taff,Steven James	25%	75%	0%
Hurley,Terrance	34%	48%	18%
Kalambokidis,Laura TJachim	30%	70%	0%
ANIMAL SCIENCE			
Linn,James	15%	75%	10%
Noll,Sally	15%	75%	10%
Seykora,Anthony	5%	25%	70%
Shurson,Gerald	5%	30%	65%
Dicostanzo,Alfredo	20%	70%	10%
ENTOMOLOGY			
Ostlie,Kenneth R	40%	60%	0%
Ragsdale,David Willard	59%	15%	26%
Hutchison,William Dale	60%	40%	0%
Spivak,Marla S	57%	14%	29%
Krischik,Vera	28%	72%	0%
COAFES - FOOD SCIENCE AND NUTRITION			
Addis,Paul B	40%	16%	45%
Feirtag,Joellen	3%	94%	3%
Schafer III,Henry W	2%	95%	3%
HORTICULTURAL SCIENCE			
Hoover,Emily Esther	17%	24%	59%
Rosen,Carl Jay	16%	81%	3%
Erwin,John E	55%	45%	0%
Meyer,Mary H	15%	85%	0%
Tong,Cindy	41%	59%	0%
Horgan, Brian	40%	60%	0%
PLANT PATHOLOGY			
Jones,Roger Kent	19%	81%	0%
Powell,Jon F	69%	31%	0%
RHETORIC			
Wahlstrom, Billie J	32%	8%	60%
SOIL, WATER, & CLIMATE			
Anderson,James L	1%	88%	11%
Lamb,John Alexander	55%	20%	25%
Moncrief,John F	21%	79%	0%
Rehm,George W	18%	79%	3%

Robert,Pierre C	50%	30%	20%
Rosen,Carl Jay	21%	60%	19%
Schmitt,Michael A	20%	80%	0%
Seeley,Mark W	21%	79%	0%
FAMILY SOCIAL SCIENCE			
Bauer,Jean W	35%	51%	14%
Danes,Sharon M	40%	60%	0%
Stum,Marlene Sue	30%	70%	0%
DESIGN, HOUSING, & APPAREL			
Bruin,Marilyn J	40%	60%	0%
CHE - FOOD SCIENCE AND NUTRITION			
Hassel,Craig Alan	28%	64%	7%
Reicks,Marla M	23%	69%	8%
FISHERIES AND WILDLIFE			
Perry II,James A	71%	11%	18%
FOREST RESOURCES			
Baughman,Melvin Jay	39%	50%	11%
Blinn,Charles Robert	18%	69%	13%
Ek,Alan Ryan	81%	11%	8%
CLINICAL AND POPULATION SCIENCES			
Fetrow,John P	32%	52%	16%
Dee,Scott Allen	64%	27%	9%