Annual Report
of
Accomplishments and Results

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

2000-2004

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Executive Summary

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.)

Goal 1 in our 2000-2004 Plan of Work comprises the following programs: Agricultural Production and Farm Business Management, Agricultural Marketing and Distribution, International Economic Competitiveness, Physiological Processes Impacting Production and Quality Traits in Agricultural Animals, Animal Production and Management Strategies, Genetic Enhancements in Animal Systems, Understanding Physiological Processes Impacting Production and Quality Traits in Cropping Systems, Genetic Enhancement in Plant Production Systems, Crop Production and Management Strategies, Value Added Agriculture, Green Industry, Food Crops, and Agricultural Information Technology.

The "Key Themes" section of this report details extension and/or research results supported with agricultural research and extension formula funds, highlights successes, and documents benefits to clientele and stakeholders.

Total Expenditures by Source of Funding

Hatch - $628,371; MRF - $32,661; Special/Comp - $112,607; State - $4,969,669; Other Federal - $1,136,466; Other Non-Federal - $2,820,595; Smith-Lever 3b & c - $369,829

Total: $10,070,198
FTE's: 145.5 (Experiment Station only)

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.)

Safety of the food we eat is of intense concern to people everywhere, and is a complex and important issue attracting efforts of the Minnesota Agricultural Experiment Station and the University of Minnesota Extension Service. The federal government has mandated increased sanitation training and stricter controls for parts of the food processing industry, creating a training component addressable by Extension. New methods are being created by Experiment Station researchers for detecting and reducing food-borne pathogens on the products being processed and marketed, be they fresh produce, dairy and poultry products, or meats.

The "Key Themes" section of this report details extension and/or research results supported with agricultural research and extension formula funds, highlights successes, and documents benefits to clientele and stakeholders.

Total Expenditures by Source of Funding

Hatch - $371,643; Special/Comp - $130,900; State - $2,208,970; Other Federal - $138,147; Other Non-Federal - $977,071; Smith-Lever 3b & c - $122,911

Total: $3,949,642
FTE's: 58.3 (Experiment Station only)

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.)

Americans are simultaneously obsessed with physical appearance yet beset with poor eating habits that lead to obesity and/or insufficient nutrition, and which may also contribute to disease. Educating people to make appropriate and nutritious food choices is a focus of important University of Minnesota Extension Service programming. While current information is applied to these educational efforts, the Minnesota Agricultural Experiment Station funds several areas of research that push the boundaries of our current knowledge base on healthy, life sustaining nutrition.

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Total Expenditures by Source of Funding

Hatch - $52,789; MRF - $9,127; Special/Comp - $47,596; State - $1,043,020; Other Federal - $263,625; Other Non-Federal - $682,170; Smith-Lever 3b & c - $118,359

Total: $2,216,686
FTE's: 25.4 (Experiment Station only)

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

The programs under Goal 4 in the 2000-2004 Plan of Work include: Maintaining Forest and Natural Resources, Integrated Pest Management, Increasing and Maintaining Diversity in Agricultural Systems, Sustainable Agriculture, Water Resource Management, and Animal Waste Management.

The "Key Themes" section of this report details extension and/or research results supported with agricultural research and extension formula funds, highlights successes, and documents benefits to clientele and stakeholders.

Total Expenditures by Source of Funding

Hatch - $235,702; MRF - $59,428; McIntire-Stennis - $238,504; Animal Health - $24,521; Special/Comp - $208,153; State - $4,217,449; Other Federal - $3,038,489; Other Non-Federal - $2,319,243; Smith-Lever 3b & c - $178,524

Total: $10,520,013
FTE's: 149.1 (Experiment Station only)

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)

The Minnesota Agricultural Experiment Station and the University of Minnesota Extension Service each view the development and implementation of information technologies to be critical to the economic, social and environmental well being of Minnesota's rural communities. Information technologies can support the sustainability of rural farm lifestyles. For example, one specific technology-precision agriculture project offers both economic benefits of reducing crop inputs and water quality benefits by avoiding excess soil amendments.

The "Key Themes" section of this report details extension and/or research results supported with agricultural research and extension formula funds, highlights successes, and documents benefits to clientele and stakeholders.

Total Expenditures by Source of Funding

Hatch - $68,741; McIntire-Stennis - $6,036; State - $889,473; Other Federal – $38,660; Other Non-Federal - $330,365; Smith-Lever 3b & c - $141,138

Total: $1,474,413
FTE's: 15.9 (Experiment Station only)

Descriptions of Planned Programs by Key Themes

Key Theme: New Uses for Agricultural Products (Research)

AES Plan of Work: Goal 1: Program 1, Agricultural Production and Farm Business Management

a. Description

Research on new uses for agricultural products includes studies of using distillers' dried grains as a promising protein/fat supplement to the homegrown grains and forages fed to dairy cattle. It also includes bioengineering studies of the development and use of extrusion cast films/sheets from agricultural materials.

Packaging films/sheets constitute a sizable portion of our municipal solid waste and their inherent non-biodegradability is a major source of pollution. In the U.S. alone, over 1 billion pounds of petroleum-based plastics are used for this purpose. Similar amounts are being used in Europe. Research into the use of natural polymers from agricultural products offers not only a new use for such products, but important environmental benefits. It is expected that approximately 50 percent of the synthetic polyester could be replaced with natural polymers leading to a significant value addition. These blends would serve as an alternative to pure petroleum-based polymers.

To promote new uses for alfalfa in the containment or removal of environmental contaminants, research has focused on selecting alfalfa for tolerance to manure or wastewater application during the growing season. Selection for mowing tolerance in alfalfa is being studied to evaluate plants in both an intensive mowing or lawn situation.

b. Impact

Research has found that the crude protein of distillers' dried grain ranged from 24 percent

to 35 percent, with 10 percent average fat content. As a result of using this as feed, some farmers have saved as much as 20 cents per cow per day in feed costs. This product has already provided ethanol producers with an opportunity for additional income by replacing soybean meal and other protein supplements with distillers dried grain in cattle diets.

Studies on extruding sheets of starch/synthetic polyester blend has shown that blends of up to 60 percent starch can be extruded with a thickness as low as 0.3 mm. Research into

the technology for making highly refined cellulose from agricultural byproducts also offers potential as a value-added process.

New alfalfa varieties for use in the containment or removal of environmental contaminants will improve nutrient cycling and protect water quality. The creation of mowing tolerant alfalfa will allow the introduction of alfalfa into parklands and golf course fairways to increase the nutrient fertility of these grassland areas without having to apply inorganic fertilizer.

Experiment Station Projects: MIN-16-047, MIN-12-092, MIN-13-028
http://www3.extension.umn.edu/mnimpacts

c. Funding: Hatch and State
d. Scope of Impact: (1) State Specific

Key Theme: Diversified Agriculture (Joint)

AES Plan of Work: Goal 1: Program 2, Agricultural Marketing and Distribution; Program 7, Understanding Physiological Processes Impacting Production and Quality Traits in Cropping Systems; Program 12, Horticultural Food Crops.

a. Description

Experiment Station research and Extension outreach programs are tackling the opportunities of diversification of Minnesota agriculture on several fronts. Several Farmers Markets have started up to provide a market place for the many new producers of vegetables and other home grown commodities. An aggressive attitude toward finding ways to enhance farm profitability and develop tax and jobs base has been the result of the ongoing educational and developmental efforts in the area of value-added agriculture in Minnesota. Extension efforts are helping farmers develop identity-preserved crops and change their management skills to match the needs of this market. Research in diversified agriculture includes developing winter hardy varieties of crops such as grapes and

blueberries, to offer more opportunities for northern growers. The development of new oat lines is providing badly needed diversification in the cropping systems in the region.

The Center for Alternative Plant and Animal Products has provided information and business development services to Minnesota farmers and organized the Minnesota Grown Opportunities (MGO) collaboration between the Minnesota Department of Agriculture, the Agricultural Utilization Research Institute, and the University to provide support to Minnesota farmers.

Extension consultation has been provided in Christmas tree production, berry production, herbicide use, Ginseng production, mushroom production, maple syrup production and Hazelnut production.

b. Impact

A web site (http://www.mgo.umn.edu) has over 150 pages of information and links on cropping livestock and farming system diversification options. Cultural practices are being developed for weed control in organically grown hard red spring wheat. With the Minnesota Christmas Tree Growers Association, researchers and specialists are helping to evaluate the production potential and marketing opportunities for new and exotic species of Christmas trees. An Extension project is supporting the Medicinal Herb Network by helping to develop marketing opportunities using the Natural Marketing Institute. In cooperation with the Small Business Development Center specialists are helping to develop a business plan for a Northwestern Minnesota based mint production and processing venture.

Extension specialists presented information on why identity preserved grains are becoming more common in agriculture. Ten farmers signed contracts for production of IP grain. Area elevators discussed with farmers their plans on how they will work with them on IP marketing. Two new cooperatives were formed this year to pursue the new markets and products that were developed by the people involved in this program.

Experiment Station Projects: MIN-13-019, MIN-21-016, MIN-21-0xx
http://www.smallgrains.org

c. Funding: Hatch, Smith-Lever and State

d. Scope of Impact: (4) Integrated Research and Education

Key Theme: Animal Genomics (Joint)

AES Plan of Work: Goal 1: Program 6, Genetic Enhancements in Animal Systems; Program 7, Understanding Physiological Processes Impacting Production and Quality Traits in Cropping Systems

a. Description

Genomic research has provided information for the genetic improvement of cattle, insights into turkey respiratory disease control, and tools for the genetic improvement of

poultry. Extension specialists have taken these findings to producers in a variety of ways, through presentations, consultations, use of the media, and development of workshops.

Each year, the dairy cattle industry loses an estimated $1billion to mastitis. Experiment Station research has been determining the genetic basis for general cattle health disorders, and mastitis in particular, with the goal of selecting dairy cows that have improved disease resistance. The genetic cause of ketosis (post-calving complications that produce loss of appetite or cattle going "off feed" and other metabolic diseases are also being investigated.

Researchers have conducted the first national evaluation of somatic cells tested in milk as lab indicators of mastitis presence. This evaluation process has since been replicated and implemented throughout the world.

Extension programs using this research include a Successful Careers in Minnesota Dairies series, including a two-day training program for milkers. The program to date has reached over 210 milkers and or managers from 70 dairy farms. These farms together had 14,000 dairy cows. Another, related, program on managing the transition cow has involved 75 dairy farm businesses with a total of 15,000 cows.

b. Impact

The genetic research into general cattle health disorders, and mastitis in particular, is expected to breed healthier cows that can increase their milk yield by at least 250 lbs per cow/year in the next 5-10 years. Cows with less mastitis will also produce milk that is higher quality, and with less likelihood of antibiotic residues from treatment for health disorders. Genetic evaluations for somatic cells scores of milk have already had a meaningful impact on the profitability of Minnesota dairy farms.

Research has shown that for each reduction in one unit linear score in the Somatic Cell Count, there is an estimated increase of 1.5 lbs additional milk produced per cow each day. Therefore, improvements in cow comfort, sanitation, and milking procedures is a consistent win for the cow, win for the farmer, as well as a win for the consumer.

Respiratory diseases of turkeys are responsible for more than $35 million in losses to Minnesota turkey producers each year. To develop a broad-spectrum live recombinant vaccine against avian influenza, researchers have successfully cloned the nucleoprotein gene in the genome of HVT (herpes virus of turkey.) Researchers are now undertaking studies to determine the protective ability of this recombined virus against various avian influenza strains.

Research to construct a genetic library of poultry pathogens offers information and a basis for combating disease-causing pathogens that cost poultry producers hundreds of millions of dollars a year. The gene library will provide the basis for designing new and effective vaccines, drugs and diagnostics for avian pathogens.

Not all genomic research is done in the laboratory. Some "old-style" genetics research is still useful. For example, since 1966, an applied research project at the Northwest Experiment Station at Crookston has selected and compared small and large cows. This research has found that means for the two sizes of cow are similar for production of milk. Many dairy producers prefer large cows, but small cows are more efficient. Small cows had productive life that was 88 days longer (15.4%) than large cows. Results from the cow size study have contributed to a new USDA genetic index in 2000. Deleterious effects of increasing body size of Holstein cows was confirmed; consequently, the new national selecting goals place negative emphasis on cow size for the future.
Experiment Station Projects: MIN-16-028, MIN-63-032, MIN-63052, And MIN-16-028
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=39
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=341
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=376
http://www.cbc.umn.edu/ResearchProjects/AGAC/Pm/pmhome.html

c. Funding: Hatch, Smith-Lever and State

d. Source of Impact: (5) Multistate Integrated Research and Education (AL, AR, IA, IL, IN, LA, MI, MN, NC, NE, NY, OH, PA, VA, WI)

Key Theme: Plant Germplasm (Research)

AES Plan of Work: Goal 1: Program 8, Genetic Enhancement in Plant Production Systems

a. Description

In the early 1970's, Minnesota AES researchers were the first to regenerate complete corn

plants from cells in tissue culture. This procedure has allowed the genetic engineering of corn. The technology also was quickly adopted to achieve the regeneration of other cereals and, in addition to the applied aspects, has led to new and powerful means of testing the behavior and functioning of plant genes that carry special importance. Ongoing research strives to identify transgenic plants which best serve food producers and consumers.

Germplasm research on several important crops such as soybeans, barley, wheat, sweet corn and potatoes is yielding important results. For example, one of the most important

diseases of soybean is the cyst nematode. Recently, it became clear that one gene, rhg1, is especially important in resistance. Research has characterized this gene, pinpointed its location on the soybean map, and developed tools to isolate it by positional cloning. In the process, researchers identified resistance genes elsewhere in the soybean genome. In another project, researchers are developing the molecular genetic tools for enhancing resistance to Fusarium head blight in wheat and barley.

Research is exploring new breeding methods to accelerate potato varietal development time while maintaining yield and quality. This includes exploiting useful genes found among the wild relatives of potato.

Evaluation of Bt sweet corn for performance on both target and non-target species is helping ensure sound environmental stewardship.

b. Impact

Transgenic corn growers have already begun to reap significantly higher yields. It is estimated that the insect-resistant corn can result in a 10 to 20 percent yield improvement. Research may increase the lysine content of current corn hybrids through genetic engineering by 50 to 100 percent, increasing its nutritional value and reducing the cost of adding lysine to livestock feed. The improved nutritional value of high lysine corn could increase the feeding value of corn by 5 to 10 cents per bushel. In the U.S. this could amount to $70 million annually to farmers producing corn or raising hogs or poultry.

A study of past economic benefits for Minnesota farmers from barley variety research documented $48 million in additional income over a ten-year period from two University of Minnesota barley varieties (Morex and Robust.) Economic analysis of 20 years of costs (research, extension) compared with benefits (farmers, malters, brewers) showed a benefit: cost ratio of 277 to 1, or an annual return of about 85 percent. When looked at on a regional basis the gain was even more, where aggregate benefits totaled almost $300 million. The latest variety release, Lacey, could potentially enhance farmers yields by 10 to 15 percent.

Studies have documented the efficacy of Bt sweet corn against European corn borer and corn earworm. These studies confirm, without the use of conventional insecticide, a very high level of insect control (98 to 100 percent in Minnesota) and high levels of marketability (usually more than 90 percent) for processing sweet corn. Research also showed minimal negative effects of Bt sweet corn on beneficial predator species.

Soybeans occupied approximately 2.0 million hectares in Minnesota in 1000 with an average yield of about 2.7 Mg/ha. Publicly developed cultivars were grown on 10 to 15 percent of the soybean hectarage. Several cultivars developed by the Minnesota

Agricultural Experiment Station are grown widely. Recently released Minnesota cultivars contributed about $16,000,000 extra income in 2000 compared with yield of older cultivars.

Experiment Station Projects: MIN-22-015, MIN-21-019, MIN-22-G06, MIN-05-026, MIN-13-022, MIN-13-022, MIN-13-032, MIN-13-030, MIN-13-027
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=19
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=407

c. Funding: Hatch and State

d. Scope of Impact: (3) Multistate Research (FL, HI, ID, IL, IN, MN, NY, OH, OR, PA, WI)

Key Theme: Agricultural Profitability (Joint)

AES Plan of Work: Goal 1: Program 1, Agricultural Production and Farm Business Management; Program 2, Agricultural Marketing and Distribution; Program 7, Understanding Physiological Processes Impacting Production and Quality Traits in Cropping Systems; Program 9, Crop Production and Management Strategies; Program 10, Value Added Agriculture; Program 13, Agricultural Information Technology

a. Description

Research and Extension work to improve Minnesota's agricultural productivity encompassed a wide range of activities—from developing and disseminating new disease-control techniques to help Minnesota's crop and animal producers, to developing management systems, providing advice on maximizing returns while minimizing costs, to developing strategies to help stabilize farm income.

For example, a project begun in 1996 carries out both research and outreach dealing with pasture management and ecology. Much applied research is initially carried out under

controlled conditions at research faculties. Agronomists, dairy and sheep scientists, an applied economist and a water quality specialist work together in order to evaluate more integrated systems of agriculture. The research findings are tested on producer farms. Through this process, test farms can be the first to benefit from applying successful methods in their operations, and they act as accessible demonstration sites for neighboring farms and communities.

An Extension program in southeastern Minnesota uses station research information to help dairy farmers increase their profitability. This includes working with families on ways to

reduce dairy heifer replacement costs by bringing those animals into the milking herd at a younger age; making sure feed costs are in line; looking at housing needs and comfort of the dairy animals; providing advice on ventilation systems and ways to reduce somatic cell counts; and making maximum use of manure to reduce purchased commercial fertilizer costs. This program has presented information on various aspects of dairy profitability to more than 1,400 dairy farmers and dairy industry personnel in workshops, barn meetings, seminars and presentation. In addition, much effort is spent in working with individual farmers or with small groups.

The University of Minnesota's Farm Resource Management Program helps equip Minnesota farm operators and landowners with the management perspectives, capabilities and information necessary to manage their farm resources. Machinery and equipment represent a major capital investment for state producers. County extension educators consistently report that the most frequently asked farm management questions are those about machinery operating costs and the going rate for custom harvesting. For more than 70 years the University of Minnesota has been doing research on farm real estate values. Continuing research includes an annual farmland sales study, published report, media coverage, web distribution and frequent Extension presentations on the subject.

Weed management is one of the most costly production challenges that face US farmers. Weed control costs can be dramatically reduced by careful fine-tuning of farm operations, but this must be done on a farm-by-farm basis. Researchers and Extension specialists are developing educational methods that help farmers carry out this fine-tuning.

Pea production for processing in Illinois, Minnesota and Wisconsin on over 200,000 acres has a raw product value of about $100 million. Common root rot, caused by a fungus, is the most serous disease affecting this crop, and may account for about $5 to $7 million in raw product losses annually. A major concern with this disease is that it is very persistent and can pose a threat for 10 years or more. Research is undergoing to determine the effects of various crop rotation strategies, and identify and evaluate management practices that reclaim and sustain pea production.

Late blight is one of the most devastating potato diseases worldwide and was responsible

for over $30 million of potato crops loss in Minnesota during the 1999-2000 growing/storage season. Currently, all commercially acceptable cultivars have no significant levels of genetic resistance to this disease. Thus, cultural practices and fungicide use are the only viable management practices available to potato farmers. A research and Extension project involving monitoring weather conditions in the potato-producing regions of Minnesota provided valuable information to farmers. When weather conditions were favorable for late blight, potential disease warnings were issued by means of a web page, e-mail service, and toll-free telephone service line. When weather was not

favorable for disease, potato farmers were able to increase the interval between fungicide applications, thus reducing the amount of fungicides applied to the crop.

A swine program uses a variety of methods—including satellite conferences, training session and publications—to relay research-based information to help pork producers meet the economic challenges that they encounter in their businesses. In many cases, Extension works cooperatively with others with an interest in pork production, such as the National Research Council and the National and Minnesota pork Producers Associations. The Extension swine program reaches a majority of the state's pork producers. The swine program holds many "train the trainers" workshops during the year that relay to veterinarians and feed industry nutritionists the latest information about nutrients and management practices. Extension also provides advice for producers in how to cut costs by different management strategies, including split-sex feeding (reducing protein levels for barrows, increasing it for gilts) phase feeding, and "all in—all out" movement of pigs, which gives producers a chance to thoroughly clean the barn, thus preventing spread of any disease organisms to the new batch of pigs.

b. Impact

The pasture management project works with approximately 100 producers individually and another 1000 producers every year through educational events. In addition, it provides training for other state and government agencies in pasture and forage management. This work offers considerable environmental and economic benefits. Using pastures instead of row crops on highly erodible land could reduce soil erosion by at least 5 to 10 tons per acre per year. Even if 100,000 acres of erodible land were converted to pasture, the impact on Minnesota waterways would be great. There are currently several million acres of cropland that would be better suited as pastures in Minnesota. Traditionally, Minnesota farmers have grown forage for use as feed on their own farms. However, cash hay production is becoming a large business in Minnesota. Not only does this provide farmers with extra income, but it also adds another cash crop in their field rotation. Research has shown that a good pasture management can increase pasture productivity by over 2 tons/acre/year. If we assume the value of that forage as hay to be $75 to $100/ton, there is the potential to increase the production value of pastureland by

over $150/acre.

In the dairy management program, results are shown on individual farms. For example, a dairy farmer was persuaded to reduce his commercial fertilizer purchases because of the amount of manure he was already applying to his corn. The farmer reported that he save more than $5,000 in one year in fertilizer costs without a drop in yields. Economic advice is especially crucial for beginning farmers. A dairy family whose son was starting in the business with them reported that advice about a ventilation system saved them $3,000.

Although the amount of post emergence herbicide used on sugar beet fields has dropped dramatically over the years, herbicides are still an expensive item for the 3,300 growers in the Red River Valley sugar beet fields of northwestern Minnesota and eastern North Dakota. An Extension sugar beet specialist has developed a micro-rate application plan of using post emergence herbicides combined with a seed oil additive. An oil additive makes the herbicide mixture adhere to the weeds better and aids in penetration. The micro-rate can be applied during the day, and the lower cost of the micro-rate of application means that it can be broadcast by aerial spraying. Ninety-seven percent of the growers who used the micro-rate said they planned to continue use.

Research suggests that incorporating oat residue into the soil through tillage has a significant suppressive effect on the root rot disease affecting pea production. Control of root rot disease in processing peas will help to retain crop diversification on 800 farm operations in Minnesota alone. In fields that are significantly affected by this disease, total crop failure is not uncommon. Assuming a slightly above average yield of 3000 pounds per acre at a value of approximately $8/cwt results in a value of about $240 per acre. At a cost of about $8 per acre to plant oats fro green manure, the net economic benefits are over $232 per acre per year.

The Late Blight Disease Forecast gave potato growers a 13-day advance warning in June 2000, which allowed savings of two fungicide applications. This project aims to improve the efficiency of potato-growing operations across Minnesota. Those likely to use the free service are the smaller farmers who, due to cost constraints, are looking for ways to reduce fixed costs.

Experiment Station Projects: MIN-13-064, MIN-13-G02, MIN-01-015, MIN-16-064, and MIN-22-024
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=1220
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=379

c. Funding: Hatch, Smith-Lever and State

d. Scope of Impact: (4) Integrated Research and Extension

Key Theme: Animal Productivity and Profitability (Research)

AES Plan of Work: Goal 1: Program 4, Physiological Processes Impacting Production and Quality Traits in Agricultural Animals; Program 5, Animal Production and Management Strategies

a. Description

Research to increase the viability of animal production systems has focused on several key areas, including feeding, housing and reproductive management strategies. For example, a 10-year research project has evaluated best management practices for raising Holstein calves as diary heifer replacements or male calves for Holstein beef production. By providing farmers with options for raising heifers or steers, this research has given farmers choices to select what best fits into his/her specific operation to provide the best economic return. Several studies have evaluated the interrelationship between health, nutrition, management, and impact on economic efficiencies. Research has also focused on grazing systems for diary heifer replacements. The project contributes to a North Central Regional Project on diary management strategies involving 24 states.

Another project seeks to increase reproductive performance of lambs and cattle. Reproductive efficiency in lamb production is well below its potential, which over time has contributed significantly to the demise of the sheep industry. Successful, cost-effective methods have been developed to decrease lambing intervals and to increase litter size. Reproductive efficiency of beef cattle is also low and impeding the industry. At present, only 72 percent of beef cows exposed to bulls wean a marketable calf within a year.

Research has shown that nursery pigs raised in a segregated early weaning (SEW) environment have a growth advantage over conventionally weaned pigs. Minnesota animal scientists and veterinarians are trying to quantify if that advantage is maintained all through the finishing phase. They are also searching for growth factors present in the SEW pigs that are absent or lower in the conventionally weaned animals.

b. Impact

Adopting specific Holstein-beef production systems have the potential to garner a $50 to $100 profit per steer. The research will positively impact a producer's ability to respond to fluctuating feed prices. Optimum nutrient management on diary farms could reduce feed costs per 100 lb milk produced by 15 to 20 percent. The current project emphasis on

diary heifer work could help save $200 to $300 for raising heifers from birth to first calving age. The attrition rate of dairy farms is 5 percent per year. This trend is expected to continue and plateau in the next 5 years. Research will not prevent attrition rate but can contribute to maintaining a strong dairy industry with 9,000 to 10,000 farmers.

Over the past five years, research on reproductive efficiency of sheep has enabled some Minnesota sheep farmers to improve their gross income by 50 percent. Successful, cost-effective methods have been developed to decrease lambing intervals and to increase litter

size. Reproductive efficiency research is also allowing beef cattle farmers to improve their yield at a rate of .05 calves/cow/year.

Research has shown that SEW pigs may reach market weight 8 percent faster than conventionally reared pigs, so a producer can market 8 percent more animals. Also, SEW pigs are about 10 percent more feed efficient. Since feed is a bout 75 percent of the cost of the pork enterprise, producers could reduce their total costs by 7.5 percent. If all pork producers adopt some forms of segregated rearing, healthier pigs will be marketed. Without SEW, pigs of all ages are kept in the same environment and diseases are continually passed from one group to another. Veterinary costs are higher and more medications are necessary. SEW yields many economic benefits: reduced feed costs, faster weight gain, and reduced health care costs.

Experiment Station Projects: MIN-16-073, MIN-16-075, And MIN-16-060
http://www3.extension.umn.edu/mnimpacts/

c. Funding: Hatch and State

d. Scope of Impact: (1) State Specific

Key Theme: Ornamental/Green Agriculture (Research)

AES 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 11, Green Industry

a. Description

Developing the ornamental and horticultural industry in Minnesota is the goal of multi-faceted Experiment Station research. By cross breeding native plants and those from different areas of the world, researchers are growing out new cultivar populations in Minnesota. Winter-tolerant trees and shrubs being developed are more aesthetically pleasing than many native plants and at the same time serve utilitarian purposes, such as for shade and windbreak. Research is finding ways for fruit producers in the upper Midwest to produce quality fruit in environmentally acceptable ways. Work continues on landscape hardiness of many types of flowers and ornamental grasses in several locations in Minnesota.

b. Impact

The new landscape plants developed carry fewer problems with insects and disease, which in turn reduce the amount of chemical pesticides applied to their areas. Because these plants are more adaptable to the harsh Minnesota weather, they can replace older plants that require pesticides and have a lower survival rate. They also provide a much greater variety of vegetation that will enable more diverse landscapes to be created. "Tri-Lights" is the 11th in the "Lights" collection of winter hardy azaleas released by the Minnesota Agricultural Experiment Station. It will be available in 2003 at nurseries and garden centers throughout the region. "My Favorite" mums is a new series of station developed, hardy chrysanthemums that reach an enormous size. Described as shrub-mums by some, they grow to over three feet in their third year. The first one "Autumn Red" will be available at nurseries and garden centers worldwide this fall. The station has released almost 80 varieties of garden mums.

In 1998 a mulch/nitrogen/irrigation study in apples was planted. Researchers are evaluating the effects of wool, woodchips, grass, or herbicide as groundcover treatments on apple tree growth. In 1999, research in bio-based weed control in strawberry production was continued. Wool mulch provided excellent weed control, excellent rooting of daughter plants, and high yields.

New varieties of strawberries, apples, blueberries, grapes and other fruits developed will benefit fruit growers in Minnesota and the northern USA due to their cold hardiness, and their disease and pest resistance.

Experiment Station Projects: MIN-21-025, MIN-21-030, MIN-21-055, MIN-21-016, And MIN-21-050
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=154

c. Funding: Hatch and State

d. Scope of Impact: (1) State Specific

Key Theme: Food Safety (Joint)

AES Plan of Work: Goal 2: A Safe and Secure Food and Fiber System

a. Description

Safety of the food we eat is of intense concern to people everywhere, and is a complex and important issue attracting efforts of the Minnesota Agricultural Experiment Station and the University of Minnesota Extension Service. The federal government has mandated increased sanitation training and stricter controls for parts of the food processing industry, creating a training component addressable by Extension, and new methods are being originated by Experiment Station researchers for detecting and reducing food-borne pathogens on the products being processed and marketed, be they fresh produce, dairy and poultry products, or meats.

b. Impact

Extension educational activities via individual contacts, group presentations, food safety certification workshops, on-site visits and facility audits, media releases, etc., have addressed safe food handling practices. Accuracy of pressure canner gauges has been

tested for dozens of businesses. Three courses sanctioned by organizations such as the Association of Food and Drug Officials were presented on seafood hazards, and were attended by personnel from more than a dozen companies and numerous individual entrepreneurs. Food safety and quality solutions were taught to 354 food processors, 66 crop producers, 29 fresh produce growers, 517 livestock producers, 475 for-profit food services and retail grocers, and 127 non-profit community organizations. More than 1,000 articles were written and released or distributed to consumers; more than 120,000 newsletters were distributed to individuals. More than 100 exhibits and workshops were presented at venues such as county fairs and farm field days. More than 5,000 food safety

publications were also distributed, and more than 4,600 individual consultations were logged by Extension staff. One follow-up evaluation showed that 56 percent of the participants in one program made the behavior change taught some or most of the time. Use of temperature gauges in lieu of subjective observation was initiated as standard practice by nearly 90 percent of participants in another program.

Experiment Station funded research is looking at several ways to retard growth of populations of food-borne pathogens. These include testing applications of anti-microbial peptides and proteins on fresh produce and in fruit juices; developing a genetically based vaccine to reduce incidence of salmonella bacteria in poultry, to reduce its subsequent transmission to people via eggs and poultry products; feeding non-pathogenic bacteria to cattle to compete with and prevent colonization in cattle of pathogenic *E. coli* bacteria; use of benign bifidobacteria and other microorganisms to deprive pathogenic bacteria of essential growth nutrients; and isolation of new natural food preservatives from sources such as pozal, an indigenous Mexican/Mayan medicinal corn fermentation.

Other Experiment Station research focuses on developing a new differential agar to improve detection of salmonella in foods, and bioluminescence technology to aid the food industry in rapidly evaluating the sanitary conditions within a processing environment. The latter technique is, over the next five years, expected to be widely adopted across the food industry, as it is cost competitive but considerably faster and more reliable than traditional methods.

Computer software is being piloted to improve dairy cattle and bulk raw milk management so as to avoid or improve control of pathogens and veterinary medical residues.

Basic research is also being done on processed food shelf life, understanding the thermal behavior of proteins in dairy products such as commercial whey and buttermilk, identifying the genetic source of a bacterial defense that might be used to combat bacterial viruses (phage) in the cheese industry, and methods for encapsulating and extending shelf life of flavor carrying esters.

Experiment Station Projects: MIN-18-G03; MIN-18-G04; MIN-18-018; MIN-18-024; MIN-18-040; MIN-18-042; MIN-18-054; MIN-18-055; MIN-18-062; MIN-18-072; MIN-18-074

http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=3
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=123
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=256
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=88
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=182

c. Funding: Hatch, Smith-Lever and State

d. Scope of Impact: (4) Integrated Research and Extension

Key Theme: Human Nutrition (Joint)

AES Plan of Work: Goal 3: A Healthy Well-Nourished Population

a. Description

Americans are simultaneously obsessed with physical appearance yet beset with poor eating habits that lead to obesity and/or insufficient nutrition, and which may also contribute to disease. Educating people to make appropriate and nutritious food choices is a focus of important University of Minnesota Extension Service programming. While current information is applied to these educational efforts, the Minnesota Agricultural Experiment Station funds several areas of research that increase our current knowledge base of healthy, life sustaining nutrition.

b. Impact

Significant Extension effort has been made to promote healthful eating among many population segments: seniors, diabetics, adult women, parents, child care providers, Native Americans, young children, pre-teens, low-income families, new immigrants, etc. About 200,000 people directly received healthful eating information via newsletters, workshops, individual consultations, group sessions, and the distribution of thousands of publications on health and nutrition. An uncountable number of others were exposed to nutrition information through articles prepared for local media. From the nearly 500 group education sessions and 3,500 individual consultations conducted by Extension staff, more than 6,300 participants reported plans to adjust their eating and food preparation to incorporate the nutritional information provided.

An Experiment Station research project is attempting to identify culturally appropriate

interventions to prevent diet related obesity. The research is specifically aimed at the rapidly increasing rates of obesity among minority populations. Another intervention study is finding some positive results from nutrition education provided within an outpatient cardiac rehabilitation program involving 104 adults, and significant increases in fruit and vegetable consumption by 250 suburban first graders from a 5-A-Day Challenge nutrition education effort have also been documented.

Specific Experiment Station funded research projects looked at the relationship of nutrition to important diseases. The link of cardiovascular disease, the leading cause of

death in the U.S., to specific dietary substances is being examined in its relationship to the development of high blood pressure. The impact of conjugate linoleic acid, a component of ordinary butter, on reducing the risk of colon cancer is being examined with the possible goal of concentrating the compound to achieve effective dietary levels. A novel dietary fiber that can be easily incorporated into drinks is being studied, as are the potential for whole grain fibers to alter antioxidant measures in the body.

Research is looking at the interactions between diet and reproductive hormones that contribute to chronic disease such as breast cancer, osteoporosis and heart disease, with the goal of formulating specific dietary recommendations for their prevention.

Basic research is under way to understand how non-pathogenic bacteria can be maintained and encouraged as a way to limit pathogenic bacteria's ability to colonize in the intestine. Another project is trying to establish measurement methods that can be used to examine how the synthesis of body fat from dietary sugars differs from that created from the consumption of less processed carbohydrates such as starches and fats.

Experiment Station Projects: MIN-54-G01; MIN-54-026; MIN-54-029; MIN-54-034; MIN-54-048; MIN-54-064; MIN-54-060; MIN-54-069; MIN-16-024
http://www.extension.umn.edu/listing.html?topic=9&subcat=68

c. Funding: Hatch, Smith-Lever, and State

d. Scope of Impact: (3) Multistate Research (CA, CO, IN, IA, KS, LA, MI, MN, NE, OH, OR, TX, WI)

Key Theme: Forest Resource Management (Research-NEW)

AES Plan of Work: Goal 4: Program 1, Maintaining Forest and Natural Resources

a. Description

The sustainability of our forests as inviting natural recreational environments, economically important timber production resources, and essential land and wildlife conservation mechanisms constitute a complex web of interrelated and competing land use desires. Use priorities for individual forests or tree stands are impacted by factors such as ownership, proximity to public resources like lakes and streams, age and type of timber within a parcel, needs to conserve marginal soils or preserve wildlife habitat, etc. The maintenance of our forest related industries, from logging to tourism, involves hundreds

of millions of dollars of economic impact. Conservation of our natural environment is an incalculable value.

b. Impact

Addressing the basic question of competing forest values, part of the Experiment Station's research aims to create economic valuations for the many non-industrial values forests provide, from their presence as carbon sequestering mechanisms to watershed protection to nature-based tourism.

Understanding the importance of diversity to the health of a forest system, and the space and buffering needs of wildlife, are the focus of several projects. Diversity is being examined through satellite imaging systems, computerized forest inventory analysis, and the development of historical and geographic databases, and through the development of mathematical models for projecting forest growth and change.

The response of forests to change, both "natural" and human initiated, constitute major investigative thrusts. One is focused on the aftermath of 1999's blow down of vast forest tracts in northern Minnesota. Another examines compaction and its impacts on forest regeneration in the aftermath of logging. The factors that make a forest healthy and productive have also been examined.

The analysis of the effects of federal and state forest policy is another area of Experiment Station funded research. Also being studied is the value of differing "incentives" for promoting better management of privately owned forest stands for timber, wildlife and water quality.

Experiment Station Projects: MIN-40-015; MIN-42-020; MIN-42-022; MIN-42-032; MIN-42-036; MIN-42-044; MIN-42-045; MIN-42-049; MIN-42-074.
http://www3.extension.umn.edu/mnimpacts/

c. Funding: Hatch and State

d. Scope of Impact: (1) State specific

Key Theme: Water Quality (Joint)

AES Plan of Work: Goal 4: Program 1, Maintaining Forest and Natural Resources; Program 5, Water Resource Management
Extension Plan of Work: Goal 4: Program 4, Soil Nutrient and Water

Management; Program 5, Improving Water Quality in the Minnesota River Basin; Program 7, Environmental Learning and Leadership

a. Description

A number of Minnesota research efforts are addressing various facets of the water quality issue, e.g., pollution causes and mechanisms, biodegradable organisms to deal with chemical pollutants, micro-irrigation and other management strategies. Other research is examining remote sensing as a means of updating forest cover and land use maps and assessing storm damage, software for land use decision making, environmentally friendly paper making processes, and policy options to promote desirable environmental goals. For example, researchers are modeling preferential flows in soils and in groundwater aquifers to determine how rapidly chemicals that are intentionally or accidentally spilled move in the environment. Knowledge of preferential flows and their inclusion in pollution models will enable better prediction of what happens to chemicals when spills occur. Studies of biodegradable plasmids and other microorganisms are determining whether these substances might be useful for cleaning up environmental contamination of surface and groundwater from pesticides and other chemicals.

Other researchers are searching for cost-effective policy approaches for reducing nonpoint agricultural pollution from soil sediment, nutrients, and chemicals in the Minnesota River Basin, a critical agricultural production and environmentally sensitive region. They found that a targeted approach to selecting production practices and specific regions could be effective in minimizing the social costs of reducing phosphorus levels by 40% in the Minnesota River. Social costs can be cut by $50 million annually if practices and regions are targeted for the greatest returns. Tradable permits are another policy option that might be used locally to control nitrate pollution of ground and surface water. And with the large proportion of forested land in Minnesota, management of forest water quality via an ecosystem approach to the development and testing of Best Management Practices and policy options, including decision-making tools, is critical to facilitating more localized policy decision making.

As useful information is generated from the research, it is incorporated in Extension

programming in sustainable natural resource management that reaches a wide variety of audiences. For example, Best Management Practices are taught to agricultural producers and woodland owners. Shoreland workshops train local natural resource professionals, lake association leaders, nursery and landscape professionals, local government officials, Shoreland Volunteers, and Master Gardeners in practices that minimize runoff/pollution. Youth are involved in learning about natural resource management and stewardship via 4-H/Youth Development activities—resident camps, day camps, and natural resource-related demonstrations and projects. People engaged in timber harvesting are taught newer resource-conserving harvesting technologies and techniques.

Partnerships with other agencies and organizations are crucial in planning and delivering natural resource management information. An estimated 43 such partnerships have been organized with entities such as the Natural Resources and Conservation Service, the Minnesota Department of Natural Resources, county governments, local Soil and Water Conservation Districts, lake associations, and numerous natural resources and conservation organizations.

Nearly 3,700 adults participated in 120 different natural resource management workshops and other activities during 1999-2000 and 56 Shoreland and Master Gardener volunteers contributed to the effort. Close to 2,100 youth were involved. Extension staff provided over 3,100 individual consultations on natural resource management. Staff also used newspaper and newsletter articles, radio broadcasts, publications, and the Internet to disseminate information.

b. Impact

Extension staff estimates that 85% of the participants in storm recovery and tree planting workshops have adopted one or more recommended practices. About half of the participants in Sustainable Forest Management workshops have adopted at least one new practice. An estimated 40% of the agricultural producer workshop participants are now using one or more recommended best management practices.

Experiment Station Projects: MIN-12-047, MIN-14-G04, MIN-14-089, MIN-25-G04, MIN-25-019, MIN-25-055, MIN-42-025, MIN-42-037, MIN-42-040, MIN-42-042, MIN-43-065

http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=1374
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=1412
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=2
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=190
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=236
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=28

c. Funding: Hatch, Smith-Lever 3b&c and State

d. Scope of Impact: (5) Multistate Integrated Research and Extension
(AL, AZ, CA, CT, CO, DE, FL, HI, IA, IN, IL, LA, KS, MN, MT, PA, SD, WA)

Key Theme: Integrated Pest Management (Research)

AES Plans of Work: Goal 4: Program 2, Integrated Pest Management

a. Description

Integrated Pest Management is an array of techniques and technologies aimed at improving, through integration of applications, the control of noxious native and foreign plants, weeds, and insect pests in crops, landscapes and the natural environment. Wider use of IPM can potentially save agricultural producers money; reduce the amounts of chemicals applied to our environment; increase plant, insect and animal diversity in the landscape; control aggressive non-native invaders; and reduce the population of disease transmitting insects.

b. Impact

Tree diseases and wood deterioration causes tremendous economic loss in Minnesota and other areas with significant forest product industries. Basic and applied studies are seeking improved knowledge of the etiology of tree diseases. The biology and ecology of Bronze Leaf Disease in hybrid poplar is being investigated, and identification of genetically resistant varieties is being pursued. The use of juvenile hormones to control pine bark beetles is being pursued, and information accumulated to date has already led to altered guidelines for oak tree pruning in order to reduce oak wilt disease in the upper Midwest.

Pest insects on crops are addressed from several directions. The ability of flowering and weed suppressing cover crops to sustain populations of beneficial parasitoids as controls for European Corn Borer and diamondback moth are being investigated. And the development of virulent microbes that specifically and only attack European Corn Borer and corn earworm are also being pursued. These pests cost U.S. corn growers more than $1 billion annually. Biological controls are also being pursued for alfalfa blotch leafminer, lepidopterous cabbage pests, the bruchid beetle pests of stored beans, and the imported cabbageworm.

Investigators are looking at controls for pests that afflict people and food animals. Basic

research into the biological mechanisms associated with insect cuticular shedding is pursuing possible new insecticidal products that will be safer for humans. The genetics of the mosquito are being searched for mechanisms to control disease transmission by them and by other medical, veterinary and agriculturally important insect pests.

Control of the invasive Canada thistle by a natural bacterium is being examined. Canada thistle infests both cropland and non-production landscapes, and knowledge of the basic mechanisms of biological control of it are expected to also be useful in developing similar controls for other widely seen invasives such as purple loosestrife.

IPM for the rural landscape is also being pursued through the mechanism of promoting plant diversity. The impact of fungi as a balancing force between competing plants is being examined with research that charts the recolonization of burned areas.

Experiment Station Projects: MIN-13-078; MIN-17-G03; MIN-17-G04; MIN-17-G11; MIN-17-046; MIN-17-052; MIN-17-055; MIN-17-057; MIN-17-060; MIN-17-062; MIN-17-066; MIN-17-068; MIN-22-069.
http://ipmworld.umn.edu/alert.htm

c. Funding: Hatch and State

d. Scope of Impact: (3) Multistate Research (AL, AR, AZ, CA, CO, CT, FL, GA, IA, ID, IL, IN, KS, KY, LA, ME, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, PR, SC, TN, TX, UT, WI, WY, Canada)

Key Theme: Soil Erosion (Joint)

AES Plan of Work: Goal 4: Program 5, Water Resource Management
Extension Plan of Work: Goal 4: Program 4, Soil Nutrient and Water Management; Program 5: Improving Water Quality in the Minnesota River Basin; Program 6, Sustainable Natural Resource Management and Stewardship

a. Description

Several research projects and Extension educational programs are addressing soil erosion/water quality issues. Research includes looking at management of eroded soils for enhancement of productivity and environmental quality, and the impact of land and water management decisions on people and their environment.

Researchers have learned that fall no-till after soybeans and chisel plowing after corn, followed by light secondary tillage in the spring is an effective system for minimizing sediment and nutrient losses in lake-draining watersheds. They also

discovered that corn and soybeans managed with an aggressive soil and water conservation approach resulted in pollution levels comparable to those from permanent cover alfalfa.

In addition, researchers are looking at the soil erosion/water quality impacts of agroforestry versus cultivated crops. They have found that the water yields from forested systems are generally lower than from cultivated crops or open fields. Young hybrid poplar stands were particularly effective in reducing water flow and also export fewer

nutrients to groundwater and streams. Streambank stability was higher, too, in comparison with crops or grasses, reducing erosion and sediment loads in rivers.

Extension has incorporated research information in crop production and management programs and promoted the use of Best Management Practices in agriculture and agroforestry. For example, The "River-Friendly Farmer" Recognition Program has been highly effective in making farmers more aware of the environmental impact of their operations and getting them to adopt Best Management Practices to reduce soil erosion and improve water quality.

b. Impact

During 1999-2000, nearly 8,500 farmers participated in 158 educational events and activities that featured soil nutrient and water quality management, manure management, irrigation management, conservation tillage, and agroforestry, etc. In addition, educators reported consulting individually with over 3,300 farmers on soil erosion and water quality-related issues. One hundred and twenty-two training sessions were held for crop consultants and other agricultural professionals who work with producers. Nearly 650 newspaper and newsletter articles were published and close to 250 radio broadcasts made. An estimated 3,000+ Minnesota River Basin farmers have adopted best management practices that reduce soil erosion and agricultural non-point pollution as of this year.

Experiment Station Projects: MIN-25-023, MIN-25-035, And MIN-42-035
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=190
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=28
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=236

c. Funding: Hatch, Smith-Lever 3b&c and State

d. Scope of impact: (5) Multistate Integrated Research and Extension (IA, IL, IN, MI, MN,
MO, ND, OH, SD, WI)

Key Theme: Soil Quality (Joint)

AES Plan of Work: Goal 4: Program 5, Water Resource Management
Extension Plan of Work: Goal 4: Program 4, Soil Nutrient and Water Management

a. Description

Improving soil quality but avoiding soil erosion and degraded water quality is a delicate balancing act that researchers are exploring. They found that incorporating high levels of plant residue in artificially drained clay/loam soils resulted in increased sediment and sediment associated nutrient (particulate P) losses via surface runoff. Tillage systems that don't incorporate surface residues and amendments, including manure applications, are more vulnerable to soluble nutrient losses in both surface runoff and subsurface drainage. These opposing impacts of minimizing sediment and associated soluble nutrient losses while also striving to reduce surface and groundwater pollution may pose a dilemma when considering high residue tillage alternatives for artificially drained soils, in place of conventional tillage systems.

Research and Outreach Center Field Days and Extension Programs continue to emphasize adopting/adapting conservation tillage systems and Best Management Practices that will help to improve soil quality and reduce erosion and water pollution from runoff. However, research demonstrates that especially in artificially drained soils, the choices that crop producers have to meet multiple goals may not be completely clear.

b. Impact

During 1999-2000, nearly 8,500 farmers participated in 158 educational events and activities that featured soil nutrient and water quality management, manure management, irrigation management, conservation tillage, and agroforestry, etc. In addition, educators reported consulting individually with over 3,300 farmers on soil erosion and water quality-related issues. One hundred and twenty-two training sessions were held for crop consultants and other agricultural professionals who work with producers. Nearly 650 newspapers and newsletter articles were published and about 250 radio broadcasts made. An estimated 3,000+ Minnesota River Basin farmers have adopted Best Management Practices that reduce soil erosion and agricultural non-point pollution as of this year.

Experiment Station Project: MIN-25-034
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=1029

c. Funding: Hatch, Smith-Lever 3b&c and State

d. Scope of Impact: (4) Integrated Research and Extension

Key Theme: Agricultural Waste Management (Research)

AES Plan of Work: Goal 4: Program 6, Animal Waste Management

a. Description

Consolidation of livestock production into fewer but larger operations is coinciding with both the sprawl of housing and other non-agricultural land uses into areas traditionally dedicated to agricultural production, and new sensitivities to quality of life issues among traditional rural farm residents. New residents in rural areas often bring with them more urban lifestyle expectations that clash with traditional prerogatives of agricultural production management. In particular, there is a growing need to accommodate these new sensibilities by controlling odors normal to agricultural production.

b. Impact

There are about 40,000 livestock producers in Minnesota. A major Experiment Station funded effort aims to develop and implement a predictor for the impact of odor emitted from these animal production sites toward downwind locations. Called OFFSET (Odor From Feedlots--Setback Estimation Tool), this predictor allows accurate estimation of setback distances needed for separation of livestock and poultry facilities from other land uses. It can be used by state agencies and local units of government to mitigate and avoid animal building siting problems, and to identify where implementation of odor control technologies can be used to reduce the impact of odors on neighbors and others near such facilities, thereby enhancing the viability of animal agriculture in the state. A farmstead odor database is also being developed to establish a baseline against which outcomes of odor reduction methods and practices can be compared.

Specifically with regard to manure, the use of biofilters for control of hydrogen sulfide and ammonia, major components of its odor, is being examined, as are the differing impacts of various approaches to applying manure as a soil amendment to different types of soil, and different techniques for covering manure storage units to reduce odor emissions.

Related to the control of manure odors is their attraction to flies and other nuisance insects. Rural surveys are measuring fly abundance in rural environments, and relating

them to human tolerance levels, with the goal of providing the data to regulatory authorities involved with pest management practices.

An Experiment Station project is also providing analysis of “difficult” agricultural materials (hog urine and feces, sugar beet byproducts, lignin from paper making pulp, diseased apples) for university departments and public agencies (36,176 tests on 21,060 samples), and soil tests on more than 15,000 samples submitted by farmers, homeowners and florists. Another project is helping 39 Minnesota cities reduce Canada Goose

populations at 120 sites. This effort contributes to improved water quality by reducing the quantity of goose droppings contaminating wetlands, streams and lakes.

Experiment Station Projects: MIN-25-046; MIN-17-050; MIN-12-062; MIN-12-082
http://www.rapidresponse.umn.edu/odor/odor2001-topic.html

c. Funding: Hatch and State

d. Scope of Impact: (3) Multistate Research (AL, CA, FL, GA, HI, IA, IL, IN, KY, LA, MN, NC, OR, SC, TN, TX, VA, WI)

Key Theme: Information Technologies (Joint)

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

a. Description

The Minnesota Agricultural Experiment Station and the University of Minnesota Extension Service each view the development and implementation of methodologies of precision agriculture to be important information technologies related to the economic, social and environmental well-being of Minnesota's agriculturally dependent rural communities. Information technologies can support the sustainability of rural farm lifestyles. For example, one specific technology-precision agriculture offers both economic benefits of reducing crop inputs and water quality benefits by avoiding excess soil amendments.

b. Impact

Investigators in the University's Biosystems and Agricultural Engineering Department, cooperating with Department of Soil, Water and Climate faculty, have been developing

and testing dry fertilizer sensors and machinery for precision agriculture. This technology enables both the precise testing and measurement of existing soil fertility, and the delivery of only the optimal amounts of fertilizer needed and utilizable by a crop grown in a specific area of a field. Precision applications in corn have been shown to prevent losses of $25-75 per acre.

A Precision Agriculture Center in the College of Agricultural, Food, and Environmental Sciences integrates research and education efforts in this area. It encourages development of information management systems and promotes their application to agriculture. Its

faculty is developing nutrient and pesticide application methods that use microprocessors, soils and crops sensors, global positioning satellites, geographic information systems and variable rate controllers to allow real-time, site-specific applications. Net gains by using precision agriculture have been shown as high as $140 per acre in sugar beets and high-value crops, and up to $20 per acre for corn and soybean. A 65 percent reduction in phosphate has been documented by one cooperating grower, for a net savings of $3,000. Educational materials are distributed to more than 1,000 crop advisors, farmers and students annually. A biennial international conference draws more than 800 participants.

Most county extension educators who work with agriculture address reducing over-application of manure as a fertilizer, as one factor in improving farm economic efficiency and increasing yields without excess nitrogen ending up in drinking water or polluting surface waters. This often involves fundamental training on sampling and testing methods, and on improved precision in calibrating manure spreading machinery, in conjunction with education on the wide variety of management activities and environmental conditions that effect the utilization of soil nutrients. Information is delivered in meetings with producer groups, demonstrations and field days, how-to clinics, and through media outlets. Savings of up to $10 per acre have been realized by producers properly using manure rather than by buying commercial fertilizers, with documented yield increases of about seven percent. More than 400 livestock producers have completed individualized manure management plans; more than 9,000 producers have participated in presentations on manure management planning.

Other information technology activities addressed potential Y2K computer problems facing farm producers, and pilot research on an "Access Minnesota Mainstreet" e-commerce curriculum.

Experiment Station Projects: MIN-12-028; MIN-53-083
http://precision.agri.umn.edu
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=1457
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=358
http://www.bae.umn.edu/extens/manure
http://www.rapidresponse.umn.edu/potato/aphidalert-topic.html

c. Funding: Hatch, Smith-Lever and State

d. Scope of Impact: (4) Integrated Research and Extension

Key Theme: Promoting Business Programs (Joint)

AES Plan of Work: Goal 5: Enhanced Economic Opportunity and Quality of Life

for Americans
Extension Plan of Work: Goal 5: Program 3, Business Retention and Expansion Strategies Program; Program 4, Tourism Development Program

a. Description

Business and industry, tourism, and forest resources are all major contributors to Minnesota's economy. Therefore, research and educational programs that strengthen these economic sectors play an important role in promoting economic growth and job development.

The Business Retention and Expansion Strategies Program has been underway in Minnesota for about 10 years. Program staff in the Applied Economics Department train and support BR&E consultants (some are Extension educators; others are private consultants) who, in turn, train and support a cadre of volunteers in communities concerned about what is happening in their economic structure. The consultants train the volunteers to conduct surveys of local businesses and industries in order to learn about their challenges and needs. Recommendations for strengthening the local climate for business and industry and improving the community generally are generated from analysis and discussion of the survey results. The end result is usually a number of community economic and structural improvement projects but the long-term results are often even more far-reaching, in terms of continued leadership and engagement of volunteers, as well as local economic growth through retention and expansion of local businesses and industries.

There were seven active BR&E Strategies Programs in operation in Minnesota in 1999-2000. Four of them are looking at "mixed" businesses; one is specialized in manufacturing, one in tourism, and one in agriculture. Forty other agencies and organizations are involved, in addition to University of Minnesota faculty and staff. Over 230 volunteers were involved in planning these programs and conducting community business and industry surveys. Over 550 firms were interviewed.

In addition, 58 new BR&E Strategies Program consultants were certified via the on-line

BR&E Consultant Certification Course during 1999-2000. These new consultants are located in 15 states, 2 Canadian Provinces, and Romania. These consultants are the resource people to the communities and volunteers who carry out BR&E Visitation Programs.

Tourism Center programs support the further development of the tourism industry in Minnesota. A variety of workshops and individual consultations are offered to tourism business owners, managers, and employees or people interested in starting a tourism

business. The Center's acclaimed "Quality Customer Service" workshop was delivered in Hawaii, Iowa, Michigan, North and South Dakota, and Wisconsin during 1999-2000.

Forest resources are another specialized economic sector in Minnesota. A variety of research efforts are aimed at finding ways to improve forest productivity, e.g., developing a genetically improved aspen and developing larch as an alternative conifer for reforestation—both significant varieties for the paper industry. Researchers are also developing economic modeling methods for forest wide planning and timber supply analysis in the Chippewa and Superior National Forests and examining the environmental impacts and alternatives of the forest industry.

b. Impact

An estimated 311 community leaders and local officials adopted new business and retention strategies as a result of participating in a BR&E Strategies Program last year. Approximately 251 existing businesses were retained and three new ones created, creating 330 new jobs. Volunteers in all seven currently active BR&E Strategy Programs had accomplished at least half of the business and community improvement projects they had planned. One community obtained $5,000 in grants to fund some of their projects.

Many new business projects in rural communities are attempting to add value to existing agricultural products produced there, while others are exploring new alternatives. For example, in Swift County, nine farmers formed a new cooperative and are exploring the export of IP grains. Two grants totaling $5,000 are funding the planting of plots to test local production of food-grade soybeans that are desirable in Asian markets. In another locality, farmers are entering into contracts to produce high oil corn and specialty small grains. Other BR&E participants are seeking to become certified to produce organic crops and one is starting an e-commerce business over the Internet.

BR&E has also helped to make rural Minnesotans more aware of the implications of the farm crisis in their communities. The Women's Farm Forum has played a vital role in raising community awareness and providing a support system for farm families who are struggling to stay in business. They also have increased awareness at the state level about

inequities in the "Minnesota Care" medical insurance program. As a result, a bill was introduced but defeated in the last legislative session. Although the bill was not initially successful, proponents have vowed to continue to work to amend the legislation that created "Minnesota Care" so that it is more readily available to farm families.

Tourism development programs were also highly effective in helping to strengthen that sector. Nearly 3,700 people participated in one or more programs during 1999-2000 and more than 70% of them indicated that they'd changed one or more business practices or procedures as a result of what they learned. Eighty-nine tourism businesses reported that

they'd increased their profitability as result of their participation in tourism development education. One hundred and sixty communities reported expanding their tourism development activities last year.

In some instances, it's too early in the game to actually measure the impact of the forest resource research, but the potential is significant. Timber and pulpwood consumption in the Lake States and the U. S. has steadily increased since the mid-1980s and is expected to double by 2040. So, development of improved aspen and larch for reforestation and ultimate harvest as pulpwood has a strong possibility for high rate of return on the investment in the research.

Much Minnesota forestland is privately owned. Therefore, encouraging the development of Forest Stewardship Plans is critical to improving the management and use of these resources. A random sample survey of 3,000 private landowners in six north central states revealed that developing Forest Stewardship Plans significantly increased these owners' implementation of 13 recommended forest management practices. In addition, 53 percent were committed enough to recommend that a friend or neighbor also develop a Forest Stewardship Plan.

Experiment Station Projects: MIN-42-070, MIN-42-086, MIN-42-089, MIN-43-054, MIN-52-073
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=237
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=409
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=1089
http://www.extension.umn.edu/mnimpacts/impact.asp?projectID=1110

c. Funding: Hatch, Smith-Lever 3b&c and State

d. Scope of Impact: (4) Integrated Research and Extension, (2) Multi-State Extension (CA, CO, DE, FL, HI, IA, ID, MI, MN, MO, NC, SC, SD, WA, WI, WV, VA)

Report on the stakeholder input process

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

In December 2000, the deans of the Colleges of Agriculture, Food and Environmental Sciences, Biological Sciences, Human Ecology, Natural Resources, Veterinary Medicine, and the University of Minnesota Extension Service conducted "listening sessions" in seven locations throughout the state of Minnesota. Over 1,200 invitations were sent to a cross-section of Minnesota residents. In addition, open invitations were placed in local newspapers and announced on local radio stations.

Also in December 2000, the College of Agricultural, Food and Environment Sciences conducted eight listening sessions throughout Minnesota. Approximately 600 people were involved in them.

During Summer 2000, each of the eight Extension Administrative districts conducted a trend analysis process. Extension educators collected and organized existing data on trends in their districts. Data was organized under eight dimensions of a healthy community--Demographics/Diversity, Economic Opportunity, Safety and Security, Life Long Learning, Environmental Stewardship, Recreational and Cultural Opportunities, Infrastructure and Services, and Community Leadership. Stakeholders were engaged in reviewing and discussing the data. Based on those discussions, 5 to 7 priority trends were identified in each district as having the most influence on the economy, environment, and quality of life over the next three years.

In addition to the preceding recent processes for gathering stakeholder input, identification of research and educational needs comes from the Regional Sustainable Partnerships in Minnesota. These entities were established in 1997 when the Minnesota Legislature dedicated a $1.2 million recurring appropriation to sustain, through a unique citizen/University partnership, the state's natural resource-based industries. The Regional Sustainable Partnership Program has established boards of directors and program development processes in five regions. These boards make monetary awards that support

research (including applied on-farm research) and educational outreach projects in their respective regions.

There are direct ties between the citizen-driven regional partnership structures and the University of Minnesota. Faculty members serve on regional boards of directors and are engaged in projects that use their expertise. Deans in three collegiate units (Agriculture, Food, and Environmental Sciences, Natural Resources, and the Extension Service) provide administrative oversight and increasingly, projects are identified in common.

In sum, the addition of these Regional Sustainable Partnership Boards to the circle of input guiding Extension priorities provides a perspective and a citizen base that is more representative of the interests of citizens than in the past.

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

For research, a cross-section of citizens from communities around our Research and Outreach Centers (out-state Experiment Stations) were selected, in addition to individuals from special interest and commodity groups. These open meetings were also announced on local radio stations and in local newspapers. Citizens were asked to respond to specific questions about their needs and how the University of Minnesota could best serve them.

For Extension, a worksheet was provided for each district team to encourage diverse stakeholder engagement. Categories included: Internal university linkages: Research and Outreach Centers, coordinate campus, Regional Partnerships, and County Extension Committee members; External Linkages such as school systems, professional groups, justice system; and Residency from various locations in the district. We sought sector balance: Agriculture, business, government agencies, education, organizations/nonprofits, health, and others. We also encouraged sex/gender balance, as well as representation by race/ethnicity, age, disability and social/economic class. In addition to these categories, we asked people to think about diversity in terms of national origin, religion, marital status and sexual orientation.

Each district team determined the process they would use to engage a cross-section of people from the preceding stakeholder categories. Examples included one-to-one interviews or small group interactions at county fairs, engagement of existing community coalitions and advisory groups, telephone surveys, and focus groups.

C. *Statement of how the collected input was considered*

For Extension, after stakeholders examined the collected data, they discussed it and rank ordered the trends they thought would be most influential over the next three years in their

district.

For research, the six deans mentioned previously, plus the associate deans for research from each of the colleges, spent many hours identifying priority areas for Experiment Station research. These areas include: 1. Enhancing Minnesota's Environment (Water Quality, Land Use Management, Ecosystems, Agriculture Waste Management); 2. Food and Health (Food Safety, Biotechnology and Risk Management, Nutrition, Foods for Prevention and Treatment of Human Diseases); and 3. Building Vital Communities (Human Capital, Value Added Resources, Technology, Entrepreneurship).

The input is also being used in strategic planning processes underway in each of the colleges.

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

Stakeholder input was critical to identifying and reaffirming priority trends in each Extension district. The process grounded and reaffirmed Extension Educators' knowledge of priority trends and resulting issues in their districts. District trends were presented in October 2000 at the annual Extension Program Summit to 470-field and campus faculty. At the same time, leaders from the four Extension Capacity Areas--Agriculture Food and Environment, Natural Resources and Environment, Youth and Family Development, and Community Vitality-- presented priority trends from a discipline perspective. (Field and campus faculty affiliate with a Capacity Area, which supports Extension work via resources, expertise, and staff and program development.)

Capacity Areas had conducted trend analysis processes similar to those in the Extension districts. They engaged stakeholders by preparing white papers summarizing the trends and related research information for discussion that were shared with stakeholders at the state or regional levels.

At the Program Summit, trends identified in the districts and through the disciplines were compared and contrasted. The process surfaced eleven key trends with five of the eleven showing strong representation in the district and the discipline or Capacity Area. District and Capacity Area Teams proceeded to hone issues resulting from the priority trends in order to identify Extension's niche or work within those issues. Capacity Areas each identified 3 or 4 priority issues in which to invest their resources over the next several years. District plans of work reflect 5 to 7 priority issues important to the district over the next several years. Approximately 70 percent of the district work aligns with Capacity Area priorities; 30 percent of the plans represent work unique to a district.

The stakeholder input from the listening sessions will have direct input into the colleges'

strategic planning processes. It will directly influence the use of resources and the direction of programs.

Update, if applicable, on the program review processes

There have been no significant changes in our program review process since the 5-year Plan of Work was submitted in 1999.

Evaluation of the success of multistate, 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 participate in 132 multi-state projects. These include NC [37], NCA [14], NCR [39], NCS [2], NE [13], NEC [1], NRSP [3], S [9], W [9], and WCC [5] projects. CRIS progress reports have been filed to document our participation in the projects. Participation in these projects by our faculty provided the opportunity to share resources across the North Central region and across the nation in some projects that had an interregional or national perspective.

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

Regional Sustainable Partnerships

With funding from the Minnesota Legislature, the University of Minnesota has established five Sustainable Regional Sustainable Partnerships in southeastern, northeastern, central, northwest, and west central Minnesota. Each partnership includes a 13 to 15 member citizen committee from the region that identifies issues/concerns related to agriculture and natural resources. Legislative funds assigned to that region are used to engage the expertise and resources of the University of Minnesota to bring solutions to issues identified. Faculty and staff from the Minnesota Agricultural Experiment Station and the University of Minnesota Extension Service are members of the regional committees and also involved in collaborative work addressing the issues identified by the regional committees.

Research and Outreach Centers

The University of Minnesota has six Research and Outreach Centers located at Grand Rapids, Crookston, Morris, Lamberton and Waseca, Minnesota. University of Minnesota Extension Service District Directors are located at four of the six Centers. Extension and Agricultural Experiment Station personnel have joint appointments located at each center. The Centers have evolved from regional agricultural research experiment stations to community centers that 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 and 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 growing effectiveness of the Centers.

Tribal College Interaction

Extension and Agricultural Experiment Station faculty have had two organizational meetings with the White Earth Tribal College and White Earth Reservation officials to identify projects that would assist in addressing community and natural resource based issues and education of Native Americans. Issues have ranged from culture of wild rice, community health and nutrition, and one result of this partnership has led to the establishment of an environmental learning center. Most of the initial contacts with White Earth have developed through a W.K. Kellogg Foundation project called “Visions for Change”. This project is one of thirteen sponsored by the Kellogg Foundation through its Food Systems Professionals Education Initiative. Increasing access to underserved populations is one of the objectives of “Visions for Change”. Further collaboration and support of initiatives at White Earth Reservation by the Minnesota Agricultural Experiment Station and the University of Minnesota Extension Service is underway.

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

In this accomplishment report, we reported on 10 joint themes with the University of Minnesota Extension Service. The Hatch dollars expended for these 10 themes totaled $822,154, which is 60 percent of the total Hatch dollars reported in this report ($1,357,246).

The actual dollars expended in FY 2000 for all Hatch projects integrated with Extension programs, which were documented on the Form CSREES-REPT (2/00) on 6/20/01, 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.

Finally, there are many other instances of programs initiating research and carrying through to dissemination through outreach in the Minnesota Impacts! database, which has been referenced throughout this document. The URL for the Impacts! website is: http://www.extension.umn.edu/mnimpacts.

FY 2000 FACULTY WITH JOINT APPOINTMENTS
RESEARCH / EXTENSION

DEPARTMENT	% RESEARCH	%EXTENSION	%TEACHING	% OTHER
APPLIED ECONOMICS				
Eidman, V.	36%	35%	29%	
Buhr, B.	40%	60%	0	
Fruin, J.	60%	40%	0	
Hurley, T.	47%	53%	0	
Lazarus, W.	20%	80%	0	
Levins, R.	16%	84%	0	
Morse, G.	18%	82%	0	
Olson, K.	40%	20%	40%	
Parliament, C.	22%	38%	40%	
Stevens, S.	15%	85%	0	
Stinson, T.	52%	48%	0	
Taff, S.	25%	75%	0	
BIOSYSTEMS & AG. ENG.				
Morey, V.	50%	25%	25%	
Jacobson, L.	25%	75%	0	
Janni, K.	55%	45%	0	
Sands, G.	35%	65%	0	
Shutske, J.	25%	75%	0	
Wilcke, W.	25%	75%	0	
AGRONOMY & PL GENET.				
Gengenbach, B.	84%	4%	12%	
Becker, R.	25%	75%	0	
Durgan, B.	26%	71%	3%	
Gunsolus, J.	30%	70%	0	
Hardman, L.	10%	76%	14%	
Oelke, E.	40%	60%	0	

ANIMAL SCIENCE				
Ponce de Leon, F. Abel	65%	15%	20%	
DiCostanzo, A.	31%	69%	0	
Linn, J.	16%	77%	7%	
Noll, S.	24%	72%	4%	
Shurson, G.	16%	24%	60%	
TBA, Beef	45%	55%	0	

ENTOMOLOGY				
Ascerno, M.	32%	37%	31%	
Hutchison, W.	60%	40%	0	
Krischik, V.	25%	75%	0	
Ostlie, K.	40%	60%	0	
Ragsdale, D.	59%	15%	26%	
Spivak, M.	57%	14%	29%	
FOOD SCIENCE				
Wartheson, J. *	45%	10%	45%	
Addis, P.	40%	15%	45%	
Feirtag, J.	20%	77%	3%	
Schafer, H.	9%	91%	0	
Tatini, S.	63%	10%	27%	
*Includes 27% - CHE				
HORTICULTURAL SCIENCE				
Gardner, G.	20%	8%	72%	
Erwin, J.	55%	45%	0	
Hoover, E.	17%	24%	59%	
Meyer, M.	15%	85%	0	
Tong, C.	41%	59%	0	
PLANT PATHOLOGY				
Pfleger, F.	35%	60%	5%	
Jones, R.	20%	80%	0	
Powell, J.	70%	30%	0	
RHETORIC				
Wahlstrom, B.	52%	8%	40%	
SOIL, WATER & CLIMATE				
Cheng, H.	12%	22%	66%	

Anderson, J.	39%	50%	11%	
Halbach, T.	20%	80%	0	
Lamb, J.	55%	20%	25%	
Moncrief, J.	21%	79%	0	
Rehm, G.	18%	79%	3%	
Robert, P.	50%	30%	20%	
Rosen, C. (Hort Sci portion)	16%	0	3%	
Rosen, C. (Soils portion)	21%	60%	0	
Schmitt, M.	20%	80%	0	

Seeley, M.	21%	79%	0	
NWROC, CROOKSTON				
Macrae, I.	40%	40%	20%	
Marx, G.	82%	18%	0	
Wiersma, J.	44%	40%	16%	
WCROC, MORRIS				
Johnston, L.	82%	18%	0	
Rudstrom, M.	67%	33%	0	
NCROC, GRAND RAPIDS				
Erkkila, D.	40%	60%	0	
Lamb, C.	71%	29%	0	
SROC, WASECA				
Baidoo, S.	80%	20%	0	
Fritz, V.	71%	29%	0	
Zhu, J.	80%	20%	0	
SWROC, LAMBERTON				
Nickel, P.	55%	45%	0	
COLLEGE OF AGRICULTURAL, FOOD, AND ENVIRONMENTAL SCIENCES FACULTY				

INTEGRATED RESEARCH AND EXTENSION ACTIVITIES		
UNIVERSITY OF MINNESOTA		
AGRICULTURAL EXPERIMENT STATION		
MINNESOTA EXTENSION SERVICE		
	PLAN OF WORK COMPONENTS	
EXTENSION PROGRAMS	**RESEARCH PROJECTS**	**HATCH $**
GOAL 1. An Agricultural System That is Highly Competitive in the Global Economy		
PROGRAMS:		
1. Ag. Prod. & Farm Bus. Mgmt.	14-022 Indicators of Financial Viability of MN Family Farms	$ 41,838
	12-092 Advanced Sensing & Control Technologies for Biological, Ag., & Food Engineering	$ 12,115
	14-035 Management Info. Systems for Firms in Food Syst.	$ 44,065
3. Int. Ag. Competitiveness	14-064 Environmental & Trade Competitiveness Issues in Agriculture	$ 58,287
4. Animal Prod. & Mgmt. Strategies	12-076 Ventilating Systems for Enhancing Indoor Environmental Quality	$ 23,674
	12-094 Biosyn. Of PRRS Viral Glycoproteins in Transgenic Animals	$ 18,515
	14-040 Economic Analysis Of Livestock Industry Marketing, Prices, Production & Policy	$ 28,846
	16-034 Improving Turkey Production Performance	$ 133,046
	16-064 Evaluation of New Nutrition Technol. For Situation Depend. Diet Formulation in Swine	$ 212,956
	16-072 Factors Affecting Success of Bovine In Vitro Fertilization	$ 1,262
	16-080 Effect of Growth Factors on Proc. in Skeletal Muscle Growth…Meat Prod. Animals	$ 30,495
5. Crop Prod. & Mgmt. Strategies	12-028 Development of Machinery Systems..Site Spec. Farming	$ 22,079
	13-019 Oat Breeding & Genetics	$ 79,661
	13-022 Molecular Cytogenetics in Plant Improvement	$ 97,608
	13-030 Barley Breeding & Genetics	$ 84,821
	13-033 Legumes in Cropping Systems	$ 123,452
	17-034 Management Strategies - European Corn Borer…	$ 40,972
	22-015 Genomics of Cyst Nematode Resistance in Soybean	$ 21,243
	22-039 Soybean Cyst Nematode	$ 2,463
	22-079 Diagnosis, Epidemiology & Control of Plant Diseases…	$ 25,199
	25-033 Improving Crop Nutrition & Ground Water Quality…	$ 26,913
	70-030 Molecular Analysis of Virulence Genes of Agro. Tumefaciens	$ 29,786
	70-042 Enzymology of Forage Processing	$ 2,375
6. Value-Added Agriculture		

7. Green Industry	21-050 Genetics & Breeding of Floricultural Crops & Native Plant Species	$ 27,658
	21-054 Biology and Utilization os Turfgrasses	$ 41,066
	21-055 Breeding, Evaluation & Selection of Hardy Landscape Plants	$ 103,485
	21-064 Molecular Analysis of Floral Gene Expression	$ 39,205
	21-083 Gene Action in Angiosperms	$ 42,665
8. Food Crops	21-019 Develop Potato Varieties & Germplasm with Improved Yield, Stab., Qual.…	$ 54,454
	21-028 Postharvest Treatments to Prolong Fresh Fruit & Vegetable Shelf-life	$ 39,006
	TOTAL HATCH DOLLARS - GOAL 1.	$1,509,210
GOAL 2. A Safe and Secure Food and Fiber System		
	18-018 Controlled Release of Encapsulated Food Flavor	$ 29,993
	18-024 Physico Chemical Properties of Dairy Macromolecules in Food Systems	$ 29,815
	18-042 Antioxidant & Antimicrobial Properties of Phenolic Compounds…	$ 8,273
	18-054 Elimination of Escherichia Coli/Salmonellae from Ready-Consume Acid Fd	$ 46,753
	18-055 In Vivo Regulatory Systems in Lactic Acid Bacteria.…	$ 31,036
	18-062 Application of Genetic Eng. Techniques for Dairy Starter Culture Improv.	$ 78,525
	18-072 Physical Chemistry of Foods: Relationships of Water Activity…	$ 37,932
	18-074 Eval., Improve. And Application of ATP Bioluminescence Tech.…	$ 29,655
	TOTAL HATCH DOLLARS - GOAL 2.	$ 291,982
GOAL 3. A Healthy, Well-Nourished Population		
	12-027 Agricultural Safety and Health Research	$ 15,602
	18-023 Functional Foods: Fiber-and Antioxidant-Enriched Foods	$ 967
	18-084 Studies on Secondary Oxidation of Various Lipids & Edible Fats In Vitro...	$ 967
	54-026 Identification of Factors Predicting Consumption of Selec Diet Constituents	$ 1,405
	54-034 Dietary Regulation os Sex Hormone Synthesis & Metabolism	$ 507
	54-057 Factors Affecting Food Acceptability	$ 16,277
	54-059 A Multicultural Investigation of Food as Medicine	$ 16,715
	54-064 Defining a Desirable Dietary Fiber Intake	$ 15,419
	54-069 Bifidobacteria, Fermentable Carbohydrate, & Colon Health	$ 20,762
	TOTAL HATCH DOLLARS - GOAL 3.	$ 88,621

GOAL 4. An Agricultural System Which Protects Natural Resources and the Environment		
PROGRAMS:		
1. Sustainable Agriculture	14-029 Decision Making for Ag. Firms Considering Risk & the Enrivon….	$ 69,579
	14-076 Economic Analysis of Limited Property Rights Transfer	$ 22,360
	17-042 Potato Insects: Biological and Cultural Control	$ 54,589
	17-049 Management of Insects and Insect Vectors of Pl. Pathogens/Potato	$ 20,523
	21-082 Plant and Root Response to Environmental Stress	$ 23,965
	22-018 Ecology of Microbes in Relation to Biocontrol and Plant Disease	$ 20,834
2. Inc. & Main. Diversity in Ag. Syst	13-067 Ecology of Diversified Grain Cropping Systems	$ 3,461
	22-074 Atmospheric Deposition: Trans. Vs. Local Air Pollutants…	$ 14,121
	22-092 Plant Biodiversity: Impact on & Interactions with …. Fungi	$ 3,508
3. Animal Waste Management		
4. Soil Nutrient & Water Management	12-047 Modeling Preferential Flow Processes in Variably-Satur. Media	$ 23,344
	14-089 Impact of Land & Water Mgmt. Decisions..MN's People & Env.	$ 64,542
	25-034 Evaluation of Fertilizer & Irrigation Mgmt. Practices….	$ 28,622
5. Imp. Water Quality in MN River…		
6. Sust. Nat. Res. Mgmt. & Steward..	22-069 Biology, Control, & Biotechnological Uses of Forest Microbes	$ 56,050
	25-054 Sustainability of Forest Production - Soil Physical Properties	$ 27,609
	43-054 Assess. Of Changing Raw Material Needs & Life Cycle Env….	$ 34,497
	43-068 Lignin Biosynthesis, Biodegradation & Derivative Plastics	$ 40,421
7. Environmental Learning/Leadership		
8. Fisheries & Wildlife Habitat Mgmt.		
9. Nat. Res. Information Service		
	TOTAL GOAL 4.	$ 508,025
GOAL 5. Enhanced Economic Opportunity and Quality of Life		
PROGRAMS:		
1. Fin. & Providing Public Services		
2. Leadership Development		
3. Business retention & Expansion…		
4. Tourism Dev.		
5. 4-H/Youth Development		

6. Urgan and Rural Landscapes	53-065 Development of Interior Mat'l. Rating Syst. For Env. Conserv…	$ 29,821
7. Personal & Family Health…	52-040 Family Systems and Family Realities	$ 12,492
	52-049 Family Boundary Ambiguity in Alzheimer's Disease….	$ 12,449
	52-054 Decision Making Integral to Relationship-Ending Transitions	$ 12,188
	52-073 Family Business: Work and Family Integration	$ 12,165
	55-035 Vital Involvement Practice: Promoting Life Strengths….	$ 12,711
	55-036 Social Support, Social Networks, & Family Violence	$ 8,845
	55-047 Professionalism Among Social Workers: Linkages…..	$ 14,476
	55-048 Patterns of Adaptation & Acceptance of Hispanics in Am. Comm.	$ 53,976
8. Ind. & Family Fin. Mgmt.	52-055 Family Economic Well-Being: Self-Sufficiency Goals….	$ 8,442
	52-077 Self-Employment: Economic Alter. To Support Hispanic	$ 12,427
	TOTAL HATCH DOLLARS - GOAL 5.	$ 189,992
	TOTAL HATCH DOLLARS -GOALS 1 THROUGH 5	**$2,587,830**
Actual Expenditures - Data from FY 99/00 AD-419		

AREERA											
FY 99/00 EXPENDITURES											
		HATCH	MRF	McINTIRE-	ANIMAL	SPECIAL/	STATE	OTHER	OTHER NON-	TOTAL	
				STENNIS	HEALTH	COMP	FUNDS	FEDERAL	FEDERAL	FUNDS	
GOAL 1											
THEME:											
New Uses	Research	***$ 12,115***	$ -	$ -	$ -	$ -	***$ 861,133***	$ 50,502	$ 691,931	$ 1,615,681	
Plant Germplasm	Research	***258,126***	666	-	-	89,198	***1,482,408***	1,075,966	1,188,115	4,094,479	
Ag. Profitability	Joint	***227,077***	-	-	-	23,409	***1,092,447***	9,998	505,158	1,858,089	
Animal Productivity	Research	***-***	470	-	-	-	***405,214***	-	84,656	490,340	
Ornamental/Green Ag	Research	***131,053***	-	-	-	-	***560,020***	-	220,981	912,054	
Animal Genomics	Joint	***-***	31,525	-	-	-	***568,447***	-	129,754	729,726	
TOTAL GOAL 1		***$ 628,371***	**$ 32,661**	**$ -**	**$ -**	**$ 112,607**	***$ 4,969,669***	**$ 1,136,466**	**$ 2,820,595**	**$ 9,700,369**	
GOAL 2											
THEME:											
Diversified Ag.	Joint	***$ 79,661***	$ -	$ -	$ -	$ -	***$ 1,175,801***	$ 29,923	$ 254,615	$ 1,540,000	
Food Safety	Joint	***291,982***	-	-	-	130,900	***1,033,169***	108,224	722,456	2,286,731	
TOTAL GOAL 2		***$ 371,643***	**$ -**	**$ -**	**$ -**	**$ 130,900**	***$ 2,208,970***	**$ 138,147**	**$ 977,071**	**$ 3,826,731**	
GOAL 3											
THEME:											
Human Nutrition	Joint	***$ 52,789***	$ 9,127	$ -	$ -	$ 47,596	***$ 1,043,020***	$ 263,625	$ 682,170	$ 2,098,327	
TOTAL GOAL 3		***$ 52,789***	**$ 9,127**	**$ -**	**$ -**	**$ 47,596**	***$ 1,043,020***	**$ 263,625**	**$ 682,170**	**$ 2,098,327**	

GOAL 4										
THEME:										
Forest Resource Mgmt	Research	***$ 27,356***	$ -	$ 163,141	$ -	$ -	***$ 1,277,568***	$ 1,266,220	$ 789,462	$ 3,523,747
Integrated Pest Mgmt	Research	***56,050***	1,330	-	-	109,444	***643,484***	1,084,094	190,886	2,085,288
Ag. Waste Mgmt	Research	***8,392***	39,975	-	24,521	-	***904,718***	82,695	817,087	1,877,388
Soil Erosion	Joint	***-***	7,504	-	-	-	***178,910***	108,388	234,890	529,692
Soil Quality	Joint	***28,662***	-	-	-	-	***105,781***	40,371	56,144	230,958
Water Quality	Joint	***115,242***	10,619	75,363	-	98,709	***1,106,988***	456,721	230,774	2,094,416
TOTAL GOAL 4		***$ 235,702***	**$ 59,428**	**$ 238,504**	**$ 24,521**	**$ 208,153**	***$ 4,217,449***	**$ 3,038,489**	**$ 2,319,243**	**$ 10,341,489**
GOAL 5										
THEME:										
Information Technol	Joint	***$ 22,079***	$ -	$ -	$ -	$ -	***$ 313,539***	$ -	$ 189,215	$ 524,833
Promoting Business	Joint	***46,662***	-	6,036	-	-	***575,934***	38,660	141,150	808,442
TOTAL GOAL 5		***$ 68,741***	**$ -**	**$ 6,036**	**$ -**	**$ -**	***$ 889,473***	**$ 38,660**	**$ 330,365**	**$ 1,333,275**
GRAND TOTAL		***$ 1,357,246***	**$ 101,216**	**$ 244,540**	**$ 24,521**	**$ 499,256**	***$ 13,328,581***	**$ 4,615,387**	**$ 7,129,444**	**$ 27,300,191**

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)							
					Actual Expenditures				
Title of Planned Program/Activity					**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
Goal 1.					$1,509,210				
Goal 2.					291,982				
Goal 3.					88,621				
Goal 4.					508,025				
Goal 5.					189,992				
Total					$2,587,830				
						Director			**Date**
Form CSREES-REPT (2/00)									