ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

North Dakota State University
North Dakota State University Extension Service
North Dakota Agricultural Experiment Station

Federal Fiscal Year 2002
(October 1, 2001 - September 30, 2002)

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Goal 1. An Agricultural System That Is Highly Competitive in the Global Economy

Overview *- Changing climate conditions, pests and prices make crop production a challenge. Through these challenges, NDSU specialists and researchers respond by helping the state's producers find ways to improve the profitability and sustainability of crop production.*

North Dakota leads the nation in production of hard red spring wheat, durum wheat, sunflower, barley, all dry edible beans, pinto beans, navy beans, canola and flaxseed. The state ranks second in production of all wheat and honey; and third in sugarbeets, lentils and rye. Exports of North Dakota commodities and products are valued at $809 million. Crop production is critically important to the economy of the Northern Great Plains. Cash receipts from crops provided nearly $3 billion to the economic base of North Dakota in 2002. A short growing season and low rainfall limits diversification, yields and cropping potential. Still, North Dakota is one of the most agriculturally diverse states in the nation with more than 40 different crops grown.

Similarly, livestock production is big business in North Dakota, accounting for 16.6 percent of total agricultural cash receipts--$639 million in 2001. And livestock production is the original value-added enterprise adding value to the state's abundant crop forage and rangeland resources. More than 44 percent of North Dakota's land use is associated with rangeland, pasture land and hayland. NDSU programs help producers cut costs, boost returns and fund new opportunities.

Since 1993, disease problems in hard red spring wheat, durum wheat and barley have increased dramatically and reduced acreage, yield and quality. As economic returns from the major crops were reduced, minor crops became increasingly important in North Dakota. Acreage of crops such as peas, canola, crambe and lentils, all of which were considered minor crops just eight or nine years ago, became major crops as producers sought increased economic gains or attempted to incorporate them into rotations in an effort to reduce the insect and disease buildup that developed under the more monoculture system. In North Dakota, lentil acreage increased from about 2,500 acres in 1993 to more than 52,000 acres in 2002. Dry peas have increased from about 2,000 acres to more than 153,000 acres during the same period. Canola increased from 20,000 acres to 1.29 million acres. North Dakota, despite its northern climate, has 2.6 million acres of soybean and 1.1 million acres of corn for grain production, which is greater than the acreage of barley, an older traditional crop in the region. Other minor, less extensive crops include carrots and onions.

The micro-rate herbicide application system developed at NDSU has been widely accepted by sugarbeet growers in North Dakota and Minnesota and shows potential for use in other cropping systems. Average savings per acre of micro-rate application in sugarbeet was $20 with a total industry cost savings of $39 million. The micro-rate system in corn weed control will reduce herbicide costs in North Dakota by $16 per acre annually. This herbicide

application method will both increase net economic income and reduce herbicide use. Major crop varieties released by NDSU in 2001 had an annual economic impact based on increased yield alone of about $30 million annually. Alsen, released two years ago, is the first hard red spring wheat variety which combines high quality and good agronomic characteristics with Type II resistance to Fusarium head blight. In addition to its impact in North Dakota, where it is sown on about 30 percent of the wheat acreage, the variety will also have an impact in South Dakota, Minnesota, and to a lesser extent, Montana. Other varieties were released for use by oat, durum, six-rowed barley and soybean producers. The acceptance of the two-rowed barley "Conlon" as a malting variety will have a major impact on barley production in central and western North Dakota. The six-row barley variety "Drummond" has been accepted by the American Malting Barley Industry as a malting variety. The benefits will also be felt in Minnesota and South Dakota to a lesser extent. The recent release of several high quality and high yielding durum varieties has had a major impact in northwestern North Dakota and northeastern Montana.

Evaluations are not limited to crops. NDSU has released 24 superior woody landscape and tree cultivars in recent years and several more are nearing release. The inventory of hardy plants for production and sale in the industry and use by landscape architects/designers, developers, city arborists, foresters, horticulturists, parks, golf courses, conservation and the public has increased markedly. That inventory is selected largely based on recommendations from NDSU's program and its collaboration with researchers across the region.

NDSU specialists also help livestock producers evaluate their operations. The North Dakota Dairy Diagnostic Program brings together teams of experts to help dairy producers identify key factors in their operations that limit profitability. One producer expanded from 81 to 250 cows while maintaining milk production at 60 lbs. per cow per day. Annual gross economic impact: $355,661. Another producer adjusted feed rations. Milk production increased 6.6 lbs. per cow per day on a herd of 210 cows. Annual gross economic impact: $48,614.

Through the combined efforts of the Office of the State Veterinarian and the North Dakota State University Extension Service, the confidentiality laws of North Dakota were changed in 1999 so that testing results for Johne's disease status were exempt from public disclosure. From 1984 to 1994, approximately 25 cases of Johne's disease were reported in cattle. In the year 2000, 370 herds were tested for Johne's and 210 were positive, indicating that more producers are willing to have their herds tested and control of the disease will be improved. In 2001 a voluntary Johne's control program was implemented to help those producers wanting to "clean up" their herds. The Office of the State Veterinarian administrated the program and the North Dakota extension veterinarian provided educational materials and clinics for veterinarians and producers. During this initial year, 19 herds were enrolled in the program.

Researchers at NDSU are studying the development of blood vessels in livestock ovaries and the relationship between that development and placenta size to fetal health and development. Results of the studies will lead to improved methods of regulating ovarian function, of obtaining large numbers of high quality embryos for use in embryo transfer programs and of optimizing

placental function and fetal growth in livestock. These improvement will give livestock producers tools to improve the reproductive management of their animals.

Key Theme - Agricultural Profitability: Assessment of Minor Crops

Much of the agronomic assessment of minor crops is conducted at NDSU Research Extension Centers located throughout the state and by one or two research projects located at the main station in Fargo. Efforts can be divided into minor crops, which involve both research and extension, and new crops, which typically involve research only because these crops are not commercially grown. Research and subsequent extension training on minor crops are typically directed toward answering producers' problems. These include variety evaluation for agronomic performance and quality, disease and insect resistance and information on agronomic practices including stand establishment, weed control, harvesting procedures and storage. Agronomists, plant pathologists, entomologists and extension personnel located at the research extension centers and at the main station and cereal scientists at the main station are heavily involved in all aspects of the work. One of the major factors that limit the production of new crops is that available varieties are not adapted to the region's growing conditions and markets are not available.

Impact: Since 1993, disease problems in hard red spring wheat, durum wheat and barley have increased dramatically and reduced acreage, yield and quality. As economic returns from the major crops were reduced, minor crops became increasingly important in North Dakota. Acreage of crops such as peas, canola, crambe and lentils, all of which were considered minor crops just eight or nine years ago, became major crops as producers sought increased economic gains or attempted to incorporate them into rotations in an effort to reduce the insect and disease buildup that developed under the more monoculture system.

The scope of the impact in North Dakota and neighboring states is demonstrated by the changes in acreage. In North Dakota, lentil acreage increased from about 2,500 acres in 1993 to more than 52,000 acres in 2002. Dry peas have increased from about 2,000 acres to more than 153,000 acres during the same period. Canola increased from 20,000 acres to 1.29 million acres. North Dakota, despite its northern climate, has 2.6 million acres of soybean and 1.1 million acres of corn for grain production, which is greater than the acreage of barley, an older traditional crop in the region. Other research and extension efforts focused on carrots and onions.

Source of federal funds: Smith-Lever and Hatch

Scope of the impact: Multi-state integrated research and extension, MN and MT

Key Theme - Plant Production Efficiency: Develop Management Strategies to Sustain Crop Productivity

Research on methods of correcting iron deficiency chlorosis in soybean by soil scientists indicated varietal selection was the most important method of control, followed by increased seeding rate. Seed treatments were found to be ineffective. In another area of research, significant efforts have been made to reduce the amount of herbicides that are applied for weed control. The technique is called micro-rate application and consists of using an adjuvant to increase the activity of the herbicide along with a reduced herbicide rate (for example: 1/8 the rate recommended by the chemical companies). Applications are made two to three times during the season. The end results are a reduction in herbicide costs to the producers and reduced amounts of total herbicide usage, resulting in a more environmentally friendly agricultural production system.

Impact: Because varietal sensitivity is the most important factor influencing iron chlorosis in soybeans, pre-screening of experimental lines by soil scientists in cooperation with plant breeders will eliminate sensitive material from being released for commercial products. Since the varieties developed are adapted to North Dakota and to a lesser extent to South Dakota and Minnesota, the research will have regional impact. The micro-rate system has been widely accepted by sugarbeet growers in North Dakota and Minnesota and shows potential for use in other cropping systems. Average savings per acre of micro-rate application in sugarbeet was $20 with a total industry cost savings of $39 million. The micro-rate system in corn weed control will reduce herbicide costs in North Dakota by $16 per acre annually. This herbicide application method will both increase net economic income and reduce herbicide use.

Source of federal funds: Smith-Lever and Hatch

Scope of the impact: Multi-state integrated research and extension, MN

Key Theme - Agricultural Competitiveness: Increase the Agricultural Producer, Consumer, Government and Social Sector Awareness, Understanding and Information regarding Agricultural Systems

Extension specialists, with assistance from research scientists, have developed several programs to describe varieties, production practices and products available. These programs are designed to address problems by the urban and rural client. Information on the global economy and the opportunities and pitfalls associated with it are being provided. Information that involves case studies of real situations is being taught in classrooms. The objective is to both stimulate independent thinking and develop teamwork, as the problems require the interpretation of concepts from several disciplines.

Impact: Clientele of the NDSU Extension Service and the North Dakota Agricultural Experiment Station are well- served by the faculty and staff of the plant sciences, soil science, cereal science, entomology and agricultural and biosystems engineering departments. All faculty, both research and extension, provide current and unbiased information to specific producers and commodity and business groups upon request. In addition, information on general

problems, practices and procedures are available to the general public for farm, rural, urban, commodity and private industry.

Today, food production is global in nature. For some producers, especially older ones, this can be a difficult concept to comprehend and special efforts must be made to strengthen the concept that rainfall patterns in South America, drought in Australia, etc., have a major impact on them. Updated information must continually be provided in order for the producer to make sound business decisions.

Several undergraduate classes include case studies where students work in small teams to solve or help provide information to solve problems. These problems are often quite complex and require a blending of several disciplines into the development of a final solution. Many of the case studies are taken from problems posed to research and extension faculty from private industry, consultants, industry, commodity groups and research extension centers. The scope of the impact is primarily on North Dakota, the surrounding states of Minnesota, South Dakota and Montana and the Canadian prairie provinces. Several methods of information dissemination are used, including radio, television, magazines and newspapers, the Internet, consumer service and printed material. In addition, numerous phone calls are received by faculty and staff who are directly accessible. The nature of the case studies given to students is such that when their schooling is complete, they must be able to reason out and solve a diversity of problems.

Source of federal funds: Smith-Lever and Hatch

Scope of the impact: Multi-state integrated research and extension, MN, MT and SD

Key Theme - Plant Germplasm: Genetic improvement of Major Crops

The North Dakota Agricultural Experiment Station has breeding and research programs in most of the region's major crops with the goal of releasing new varieties. Germplasm from these research programs is shared with public and private breeders worldwide. In sunflower and sugarbeet, which are also major crops, germplasm is released by the USDA for use by private and public breeding programs. USDA scientists provide basic genetic information and, in some cases develop and provide germplasm to assist the NDSU breeding programs. In some crops, the USDA coordinates regional trials that allow plant breeders to determine the adaptability of their genetic material across a wide range of environments outside North Dakota. The NDSU plant breeders, which are located in the department of plant sciences, cooperate extensively with their counterparts in the departments of plant pathology, entomology and cereal science and the research extension centers in varietal development and genetic research. Crosses made by the breeder are evaluated for agronomic characteristics by the breeder, quality characteristics by cereal scientists and disease and insect resistance by plant pathologists and entomologists. Based on the information provided, the breeder then makes a decision on which material to discard and which to move forward in the program. The extension service has a major role in educating the producers about new varieties.

Impact: Genetically improved varieties that possess improved agronomic performance and quality have a major economic impact on the state and region. Varieties that have increased yield and improved disease resistance and quality provide producers with the opportunity to increase their economic potential through wider accessibility to markets and improved prices. The genetic improvement of major crops for successful crop production requires research effort by the scientist and subsequent dissemination of the knowledge to producers, product purchasers and end users of the finished product by extension personnel. Extension efforts are directed at the state, county, national and international levels.

Several new and improved crop varieties were developed and released using conventional methods of plant breeding. Some of these varieties have increased yield due to improved disease resistance, especially head, kernel and leaf disease resistance, while other releases have improved agronomic, quality factors and sometimes insect resistance. Examples include: greater test weight, kernel size and higher protein for wheat; improved milling extraction percentage and lower protein in barley for malting; increased fiber level in oat for human consumption; specific oat varieties for race horses; and hulless oats for improved livestock feeding efficiency.

Varieties released by NDSU in 2001 had an annual economic impact based on increased yield alone of about $30 million annually. Alsen, released two years ago, is the first hard red spring wheat variety which combines high quality and good agronomic characteristics with Type II resistance to Fusarium head blight. In addition to its impact in North Dakota, where it is sown on about 30 percent of the wheat acreage, the variety will also have an impact in South Dakota, Minnesota, and to a lesser extent, Montana. If the variety is approved for production in Canada, where it is well-adapted, it will also have a significant economic impact there.

Other varieties were released for use by oat, durum, six-rowed barley and soybean producers. The acceptance of the two-rowed barley "Conlon" as a malting variety will have a major impact on barley production in central and western North Dakota. The six-row barley variety "Drummond" has been accepted by the American Malting Barley Industry as a malting variety. The benefits will also be felt in Minnesota and South Dakota to a lesser extent. The recent release of several high quality and high yielding durum varieties has had a major impact in northwestern North Dakota and northeastern Montana. The education of producers about the strengths and weaknesses of new varieties is a primary function of the extension service. A typical crop variety lasts five to six years, at which time it is probably replaced by another that possesses improved agronomic characteristics and yield. If the variety finds a niche area or market, it can last much longer. As a result, there is a continual need for programs to provide producers the option to select those varieties that best fit their needs from public and private breeding programs.

Source of federal funds: Smith-Lever and Hatch

Scope of impact: Multi-state integrated research and extension, SD, MN and MT

Key Theme - Ornamental/Green Agriculture - Woody Ornamental Evaluation

Researchers evaluate hundreds of woody plants for performance and hardiness in North Dakota. Researchers are beginning the fourth year of evaluations on 100 cultivars of flowering crabapple and those evaluations will lead to significant revisions in recommendations made to nurseries, landscape companies and their clientele. Evaluations were made on 375 other woody accessions, many at multiple sites in the state. NDSU researchers collaborate in national and regional nursery plant evaluation programs.

Impact: NDSU has released 24 superior woody landscape and tree cultivars in recent years and several more are nearing release. The inventory of hardy plants for production and sale in the industry and use by landscape architects/designers, developers, city arborists, foresters, horticulturists, parks, golf courses, conservation and the public has increased markedly. That inventory is selected largely based on recommendations from NDSU's program and its collaboration with researchers across the region.

Source of federal funds: MacIntire - Stennis, Hatch and Smith-Lever

Scope of impact: Multi-state integrated research and extension, MN and SD

Key Theme - Plant Health: Development of Midge-Resistant Sunflower

Sunflower midge, Contarinia schulzi, has the potential to severely damage sunflower. It has also proven to be impossible to control using insecticides. Sunflower resistance to the midge is a potential management option. However, the development of midge-resistant hybrids has not occurred because natural populations are usually insufficient to test for resistance and artificial infestation methods are not available. A technique to simulate damage using a synthetic plant auxin applied to seedling sunflower has the potential of allowing large numbers of sunflower to be tested rapidly.

Impact: In areas where sunflower midge has caused severe damage, sunflower production has declined in part because of recurring losses to the midge. Sunflower with resistance to the midge would provide growers greater confidence in their ability to grow a quality sunflower crop in areas where sunflower midge is a potential pest.

Source of federal funds: Hatch.

Scope of impact: Sunflower midge is widespread in eastern North Dakota, western Minnesota, Manitoba, and is found in parts of South Dakota.

Key Theme - Plant Germplasm: Mechanisms of Host-Plant Selection in Wheat Midge

The wheat midge attacks developing wheat kernels and is a serious pest in North America, Europe and Asia. For related midges, such as the Hessian fly and rice gall midge, host plant resistance has, for many decades, been an effective means of pest management. For the wheat midge, success in finding host-plant resistance eluded scientists until recently when Canadian researchers reported the discovery of a highly effective resistance that causes the death of wheat midge larvae before they establish a feeding site. This newly discovered resistance is conferred by a single gene. Within the next three to five years, it is anticipated that common and durum wheat cultivars, all carrying this single resistance gene, will be deployed across the Northern Plains of North America. There are concerns that the wheat midge will overcome this resistance gene through evolutionary modification. Combining, within a single wheat cultivar, traits that kill larvae with traits that reduce the number of eggs placed on the plant by the adult female might provide more sustainable control of the wheat midge. We will explore the potential for reducing egg numbers by studying fundamental aspects of the oviposition behavior of the wheat midge. Specific research objectives are to determine whether wheat midge females 1) locate wheat heads using odor cues and 2) respond to chemical and tactile traits of wheat heads during on-plant examining behaviors.

Impact: Wheat midge can cut wheat yields by up to 50 percent. If the pest overcomes a single resistance trait, damage could be widespread and significant and the effort spent to introduce that trait into adapted varieties would be wasted. Introducing multiple-trait resistance into adapted varieties likely would provide more sustainable control of the wheat midge.

Source of federal funds: Hatch.

Scope of impact: SD, MT, MN and Canada

Key Theme - Agricultural Competitiveness: County Cropping Systems

Extension staff developed a comprehensive program to provide LaMoure County producers up-to-date and local information on cropping systems while helping them make transitions from one crop to another with as little negative impact on profitability as possible.

To help producers with information on soybeans, small grain and sunflower varieties, staff work with area groups and establish variety plots. Annual plot tours feature a review of varieties/hybrids and current topics of interest to producers, such as insect problems, crop rotations, production practices, markets, herbicide comparisons and plant population studies. After the plots are harvested, data is compiled, printed and disseminated to producers in LaMoure and neighboring counties. The results are also printed in the annual Crop Production Guide and variety trial bulletins are printed by the NDSU Extension Service.

Throughout the winter meeting season, staff either holds or invites producers to area production meetings to fine-tune their production skills.

Cooperating institutions and organizations: LaMoure County Extension Office; Allied Agronomy Services of Edgeley; Dakota Prairie Ag, Edgeley; National Sunflower Association;

North Dakota Soybean Council; and soybean, sunflower seed companies; Dr. Mike McMullen, NDSU Oats Breeder; ADM Plant, Enderlin; the LaMoure County Ag Improvement Association and producers: Tom Kiecker of Edgeley , Ron VanBruggen of Litchville and Terry Lebhan of Litchville.

Impact: With more favorable prices and reduced problems with insects and disease, many producers were looking to switch from hard red spring wheat to soybean and corn production. Most had little or no experience growing these crops. Because of crop tours, workshops and seminars, most producers made the switch and successfully increased gross revenues.

In 1995, LaMoure County had fewer than 9,000 acres in soybeans and more than 210,000 acres in hard red spring wheat. By 2002, soybean acreage had increased to more than 138,000 acres and hard red spring wheat acres had decreased to 161,000. The economic impact from this change was approximately $1.7 million of additional gross revenue for LaMoure County producers. A larger increase was seen on the conversion of barley, oats and sunflower acres to soybeans.

Source of federal funds: Smith-Lever

Scope of impact: State specific

Key Theme - Plant Health: Diagnosis and Management of Root Disease in Western North Dakota

The area extension cropping systems specialist, state extension plant pathologist and county agents in southwestern North Dakota developed a demonstration using a soil fumigant to show producers yield and quality losses that can be expected in continuous wheat, wheat every other year and when at least a two-year break occurs between wheat crops. Also, nitrate levels in the root zone were compared between fumigated and non-fumigated soils to illustrate the potential environmental impact that continuous wheat may have should nitrates leach below the root zone. These demonstrations were observed and discussed with producers at field days and county agricultural improvement tours. Presentations were developed and given to producer groups and were included in the NDSU Extension Service CD which is distributed to county agents across the state.

Cooperating institutions and organizations: North Dakota State University Cooperative Extension Service, Montana State University Cooperative Extension Service, Dickinson Research Extension Center, Hettinger Research Extension Center, County Extension Services and County Crop Improvement Associations in Adams, Golden Valley, Hettinger, Mercer, McLean, Morton, Oliver and Sioux counties and the Sustainable Agriculture Mini-grant Program administered by NDSU Extension Service.

Impact: Producers who are including a two-year break in their crop rotation are seeing an increase in gross income of $36 per acre when wheat is grown in comparison to continuous wheat. Producers are also financially benefitting from alternative/specialty crops that are seeded

during the two years between wheat crops. Some producers have reported up to $40 per acre return on specialty crops grown. Producers have also learned they can produce yields comparable to and sometimes greater than those from fallow. Fallow acreage in southwestern North Dakota has declined by 604,000 acres since the demonstration was initiated. Also, wheat and barley acreage has decreased by 300,000 acres each, indicating that fewer acres of continuous wheat and barley are being sown in this part of the state. In 1996, 72 percent of the wheat planted in southwestern North Dakota was on wheat, barley or durum stubble. Acres planted to other crops have increased. In 2002, 67 percent of the wheat grown in southwestern North Dakota was grown on wheat, barley or durum stubble. These data would indicate that producers are increasing the use of crop rotations to improve efficiency in crop production. This change may in part be attributed to the work that has been done with this project.

Source of federal funds: Smith-Lever

Scope of impact: Multi-state extension, MT and SD

Key Theme - Plant Production Efficiency: Sunflower Date of Planting in Western North Dakota

The area extension cropping systems specialist and the Slope County extension agent developed a demonstration to show producers the effect that moving the planting date from late to early has on yield and quality of NuSun sunflower oil produced. In the three years that this demonstration has been conducted, plant stand establishment for late-April and early-May seeding dates was significantly lower than for sunflower planted after mid-May. Seed yields were greatest two out of the three years when sunflower was sown May 23. In terms of oleic content, a desirable fatty acid, mid-May to early-June planting was significantly higher than either the early seeding dates or planting dates after early-June. The information gained from the demonstration has been shared with producers during tours of the demonstration plot as well as at producer meetings.

Cooperating institutions and organizations: Slope County Crop and Livestock Improvement Association, Slope County Extension Service, North Dakota Cooperative Extension Service, National Sunflower Association, North Dakota Board of Agricultural Research and Education, USDA Agricultural Research Service, Fargo, ND, Hettinger Research Extension Center, Dickinson Research Extension Center and Mycogen Seeds, Inc.

Impact: Twenty-three producers indicated they have adjusted sunflower planting dates to occur at or about May 23. It is estimated that these 23 producers increased income based on yield and quality factors by $35 per acre or a total of $241,500.

Source of federal funds: Smith-Lever

Scope of impact: Integrated research and extension

Key Theme - Plant Health: Plant Diagnostic Lab in Southwest North Dakota

Growers and the agricultural industry expect fast and accurate response in identifying agricultural pests and potential pests. Proper identification of pest problems is important for implementing effective corrective actions or avoiding costly and unnecessary pesticide applications. Five satellite plant diagnostic labs were initiated around the state of North Dakota.

Cooperating institutions and organizations: North Dakota State University Cooperative Extension Service, North Dakota State University plant pest diagnostician, extension service plant pathologist, extension service entomologist and participating area extension specialists.

Impact: Twenty-one agricultural problems were identified using the plant diagnostic equipment
at the Dickinson Research Extension Center. An elevator brought in one insect it had originally identified as a confused flour beetle. Under close examination with a stereo scope, the insect was identified as a fungus beetle and treatment of grain with a fumigant was avoided, saving the elevator $1,500. Wheat curl mites were identified on Wheat Streak Mosaic Virus (WSMV) symptomatic plants using the diagnostic equipment. In the summer of 2002, several producers lost entire fields or suffered yield and quality losses from WSMV. Seven producers are known to have delayed seeding of winter wheat, a recommended practice for the control of WSMV, because of the diagnosis. If this wheat avoids WSMV in the spring of 2003, these producers will see an increase of income.

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension

Key Theme: Emerging Infectious Diseases Sugarbeet Disease Research

North Dakota ranks second in production of sugarbeet, providing 17 percent of the nations's supply. In 1998, sugarbeet growers in North Dakota and Minnesota lost $113 million to a Cercospora leaf spot epidemic. Some isolates of Cercospora were found to be resistant and/or tolerant to the benzimidazole and triphenyltin hydroxide fungicides. From 1999 through 2002, the EPA has granted our researchers request to use Eminent, a tetraconazole fungicide, to control Cercospora leaf spot. The average number of fungicide applications applied per acre was reduced from 3.74 in 1998 to 2.6 in 2002, and Cercospora control was good to excellent in most fields. Rhizomania and Rhizoctonia are also becoming more severe in sugarbeet fields. Management strategies are being developed to better manage these diseases using resistant varieties and fungicides where applicable.

Impact: Researchers tested a prediction model for timing fungicide applications and tested different fungicides that will control Cercospora including resistant and /or tolerant strains. This has led to the full registration of two new effective strobilurin fungicides, Headline and Gem. Efforts are still in place to have a full label for Eminent to be used in an alternation program with the strobilurins to control Cercospora and manage fungicide resistance. Researchers in North Dakota, Minnesota and Montana are also looking at control strategies that integrate disease resistant crops and timely fungicide applications.

Source of federal funds: Hatch and Smith-Lever

Scope of impact: Multi-state research and extension, MN and MT

Key Theme - Niche Markets: Evaluation of Wheat Quality in Relation to End Use

Limited information is available regarding the quality requirements for certain specialty wheat-based products such as frozen doughs and Asian noodles. Wheat cultivars with specific starch and protein characteristics impart desirable quality traits. NDSU researchers are identifying and evaluating hard red spring wheat and hard white spring wheat varieties that could be sold in an identity preserved basis for use in a selection of wheat-based products.

Impact: Researchers identified key quality characteristics and identified several wheat varieties with potential for frozen dough and noodle production. The information from the research will allow wheat breeders and cereal chemists to improve the quality of existing wheat lines, broaden the applications of hard red spring wheat and hard white spring wheat in specialty products and allow the industry to respond faster to new emerging domestic and international market demands.

Source of federal funds: Hatch

Scope of impact: Multistate research, MN, SD

Key Theme - Niche Markets: Improved Processes for Foods

Improved technology is needed to process low-volume, high-value niche oilseed crops grown on the Upper Great Plains. Existing methods rely heavily on the use of solvents which are not allowed for some applications or may otherwise be infeasible for niche seeds. In addition, the engineering and biochemical properties of niche oilseeds and many other foods are not sufficiently understood. NDSU researchers are developing methods for the engineering and biochemical analysis of these oilseeds. That will provide the basis for improvements in processing of these crops by non-solvent methods.

Impact: Screw processing of oilseeds is gaining importance and several processing facilities have been established recently in the north-central United States. This research will help establish optimal process methods for screw pressing new crops such as crambe seed. Tofu and other soy protein products are recognized for their phytochemicals. The methods developed to characterize texture of these produces will help ensure acceptance by consumers.

Source of federal funds: Hatch

Scope of impact: Multi-state

Program 2: Competitive and Profitable Animal Production

Key Theme - Agricultural Profitability: North Dakota Dairy Diagnostic Program

The North Dakota Dairy Diagnostic Program (ND3P) is a joint effort of the North Dakota Dairy Strategic Planning Task Force, North Dakota State University Extension Service, related dairy industry contributors, dairy farm families and North Dakota Agricultural Products Utilization Commission (APUC). This novel program is a concept developed and refined by the dairy strategic planning task force, and represents a portion of its long-range plans to revitalize the state's dairy industry. The ND3P program demonstrated obvious empirical and financial success during the 'pilot' program. Those results provided sufficient evidence that an expanded program would contribute to increased profitability for dairy farm families. That resulted in phase two (growth phase) of the program. The documented increases in gross income and economic impact by participating dairy farms provided convincing evidence for continued support. We now enter phase three, to become self-sufficient. To accomplish that task, we continue to seek extramural and long-range funding, the most notable of which is the three-year contract with Cass Clay Creameries. It is providing payment of program fees for any of its patrons that enroll in ND3P. In the meantime, partial legislative support remains in place and fees from the participating dairy farms, as well as other contributions, promote continued program growth.

Impact: At the completion of phase two, ND3P had attained its initial goal of involving 10 percent of the state's dairy farm families in the program. Currently, ND3P has entered into discussions with the North Dakota Pork Producers directors about providing assistance in developing a diagnostic program for their growers. We have offered to help other interested groups with operational challenges and provide guidance in building a similar program by providing expertise in facilitation and administrative duties to develop a diagnostic program.

Some of the more significant success stories are summarized below. It does not represent all of the participants, but highlights some of the most notable accomplishments. Also noteworthy is the unique outcome of ND3P efforts in Emmons County where individuals formed a dairy community support group. This group provides an outlet for dairy farm families to discuss the mutual challenges of dairying and provides general support on many issues common among dairy farm families.

Accomplishments from 18 selected farms (53 farms have been involved in the program):

<u>Farms 1 through 14 report changes in annual gross impact</u>:

Farm 1. Expanded from 87 to 130 cows while maintaining milk production at 57 lbs. per cow per day. *Annual gross economic impact*: $85,969

Farm 2. Expanded from 81 to 250 cows while maintaining milk production at 60 lbs. per cow per day. *Annual gross economic impact*: $355,661

Farm 3. Instituted herd health and vaccination program, which increased milk production from 57 to 71 lbs. per cow per day while lowering feed costs by $0.37 per cow per day on 88 head. *Annual gross economic impact*: $53,143

Farm 4. Decreased DA's from 10 to 0 in a seven-month period by reformulating the lactation diet. *Annual gross economic impact*: $2,363**

Farm 5. Milk production increased 9.2 lbs. per cow per day on a herd of 34 cows. Feed costs decreased $0.37 per cow per day. *Annual gross economic impact*: $14,808

Farm 6. Milk production increased 12.4 lbs. per cow per day on a herd of 54 cows. SCC decreased 88,000 (from 278,000 to 190,000) for the same period. *Annual gross economic impact*: $40,062***

Farm 7. Increased milk production 17.6 lbs. per cow per day on a herd of 33 cows. *Annual gross economic impact*: $20,372

Farm 8. Adjusted feed ration. Milk production increased 6.6 lbs. per cow per day on a herd of 210 cows. *Annual gross economic impact*: $48,614

Farm 9. Milk production increased 5.8 lbs. per cow; milk check up $1,062 in two months. *Annual gross economic impact*: $6,362

Farm10. Milk production increased 4.5 lbs. per cow; milk check up $845 per month. *Annual gross economic impact*: $10,140

Farm 11. Milk production increased 12.3 lbs. per cow; milk check up $1,338 in two months. *Annual gross economic impact*: $8026

Farm 12. Milk production increased 6.5 lbs. per cow; milk check up $1,042 per month. *Annual gross economic impact:* $12,504

Farm 13. Adjusted feed ration, milk production increased 21 lbs.; milk check up $3,036 in two months. *Annual gross economic impact*: $18,216

Farm 14. Milk production up 4.9 lbs. per cow per day at 60 cows milking = 294 lbs./day, or $920.80 per month. *Annual gross economic impact*: $11,760

<u>Farms 15 through 18 report changes in annual net return:</u>

Farm 15. In one year, expanded herd from 110 to 208 cows. Feed costs decreased from $5.21 to $4.41 per cwt. of milk. Milk production increased from 21,069 lbs. to 22,528 lbs. Net return increased after all direct and overhead costs from $73,773 to $93,059. *Annual net return*: $19,286****

Farm 16. Net return from above dairy enterprise in second year went from $93,059 to $114,035. *Annual net return*: $20,976****

Farm 17. In one year, direct expenses per cwt. of milk dropped $0.80, feed cost per cow dropped $0.54, net return increased after all direct and overhead costs from $20,993 to $34,956. *Annual net return*: $14,023****

Farm 18. In one year, direct cost/cwt. of milk dropped $1.11, milk produced/cow increased 1,472 lbs., feed cost/cwt. of milk dropped $1.42, total direct and overhead expense for dairy replacement per head sold or transferred dropped $256.29. *Annual net return*: $6,924****

* Based on $11.50 per cwt. milk price and a 305-day period; typically return to labor and management is 30 percent of gross.
**R.B. Corbett, Dairy World, Jan-Feb 1999, p4. 750 lb. minimum loss per lactation, $150 (conservative) cost per surgery.
*** Premium based on $0.002 per 1000 SCC per cwt.
**** Actual net return increase after all expenses including depreciation and inventory changes.

Source of federal funds: Smith-Lever

Scope of impact: State specific

Key Theme - Animal Health: Volunteer Johne's Program for North Dakota

In conjunction with the Office of the State Veterinarian, we assessed and developed a voluntary Johne's control program for North Dakota dairy and beef producers to help control Mycobacterium avium paratuberculosis in cattle.

Impact: Through the combined efforts of the Office of the State Veterinarian and the North Dakota State University Extension Service, the confidentiality laws of North Dakota were changed in 1999 so that testing results for Johne's disease status were exempt from public disclosure. From 1984 to 1994, approximately 25 cases of Johne's disease were reported in cattle. In the year 2000, 370 herds were tested for Johne's and 210 were positive, indicating that more producers are willing to have their herds tested and control of the disease will be improved.

In 2001, a voluntary Johne's control program was implemented to help those producers wanting to "clean up" their herds. The Office of the State Veterinarian administrated the program and the North Dakota extension veterinarian provided educational materials and clinics for veterinarians and producers. During this initial year, 19 herds were enrolled in the program.

An additional initiative was also implemented with the 2001 voluntary Johne's control program called the "C-punch." To control Johne's in cattle, a permanent identification needs to be placed on the animal. Some states have instituted a "J-punch" program whereby infected cattle are ear notched with a letter "J" to signify Johne's. In North Dakota, we were concerned about

stigmatizing producers and their cattle by placing a "J" in the cattle's ear. In response, the "C-punch" was developed. The letter "C" stands for cull. Animals ear notched by this means signify to sale barns, order buyers and other potential purchasers of livestock that cattle marked with a "C" are intended for the slaughter market only and are not to be put back into a production unit. The "C-punch" signifies that an animal is intended for cull only. It does not imply a production unit is infected with Johne's. "C-punches" have been provided to all livestock auction markets across the state and to veterinarians and producers who wish to use the device. Multiple states have contacted North Dakota with the desire to start a "C-punch" program.

The long-range impact of this program will be national. Many states (e.g. Hawaii) have contacted North Dakota with the hopes of following North Dakota's lead in establishing a voluntary Johne's control program and the use of the "C-punch."

Source of federal funds: Smith-Lever

Scope of impact: Multi-state research and extension

Key Theme - Animal Health: West Nile Virus

In conjunction with the State Veterinarian's office, the North Dakota Dept. of Health and the NDSU Veterinary Diagnostic laboratory, a surveillance system for West Nile Virus and an education initiative were implemented.

In the summer of 2002, West Nile Virus spread across the Upper Great Plains. In North Dakota, 579 horses were affected and 35 percent of those died. The first case was reported on June 30. August had the most cases with 350. In response to this emerging disease, a conference was organized to educate veterinary practitioners on West Nile Virus and appropriate response and treatment.

Rob Keene, international expert on West Nile Virus from Fort Dodge (the only supplier of West Nile Virus vaccine in North America) presented to approximately 30 veterinarians in August. Simultaneously press and news releases were written and transmitted across North Dakota to educate the public. At this time it is unknown how many horses were actually vaccinated, but based on anecdotal evidence, thousands were vaccinated and were provided some protection.

Short-term impact: The outbreak in 2003 should be less, but unknown at this time.

Long-term impact: West Nile Virus will now be considered endemic and will become a routine vaccination protocol unless some unknown adverse event occurs.

Source of federal funds: Smith-Lever

Scope of impact: Multi-state research and extension

Key Theme - Adding Value to New and Old Agricultural Products: Lean lamb

Extension specialists have helped the Dakota Lamb Growers Cooperative develop specifications for "Dakota Lean Lamb" and "Natural Lamb." The cooperative began selling lambs on the East Coast in the spring of 2001 under the label "Dakota Lean Natural Lamb." Initial customers for the company have been upscale supermarket chains, natural food outlets and food service companies. Currently, Dakota Lamb Growers Cooperative is shipping natural boxed and carcass lamb to Massachusetts, North Carolina, Minnesota, Arizona, Colorado, Ohio and North Dakota. New sausage products are also being developed. Assistance was provided in the facilitation of informational meetings for the cooperative, initial newsletter preparation, a sheep school on lamb grading and feeding and continued advisory support when needed. Two extension specialists serve on the advisory board to the cooperative.

Impact: This grass-roots approach to marketing lamb to increase producer returns has yielded a current membership of 184 members in the cooperative from North Dakota, South Dakota, Minnesota and Montana. Dakota Lamb Growers Cooperative has established a reputation as a reliable supplier of quality natural lamb. The producer-shareholders are paid a base price for their lambs that is profitable on a year-round basis. In addition, they receive seasonal premiums for certain times of the year when fewer lambs are available and quality incentives for leanness and loin eye size. Having gained the attention of several very large customers, the cooperative is now marketing 150-250 lambs per week. They are also in the progress of starting to market name brand sausage products. The Dakota Lamb Growers Cooperative is one of the bright spots in the North Dakota sheep industry as a value-added industry.

Source of federal funds: Smith-Lever

Scope of impact: SD, MN and MT

Key Theme - Agricultural Profitability: Feedlot Development in North Dakota

Several demonstration projects were conducted to determine the value of feeding producer-owned cattle in North Dakota. With that information, cattle producers from across the state developed the North Dakota Statewide Cattle Feeders Consortium. That group conducted a feasibility study and developed business plans to build large cooperatively owned feedyards. The North Dakota State University Extension Service developed the North Dakota feedlot school and advanced cattle feeding workshops and backgrounding/feeding seminars for lenders and feeders to enhance feedlot management skills and improve knowledge of feeding and marketing.

Impact: The NDSU Extension Service showed that it cost up to 3 cents less per pound to finish cattle in North Dakota compared to an out-of-state feedlot. Extension information prompted a group of cattle producers to pool funds and custom feed more than 4,500 head in North Dakota feedlots. With help from extension specialists and agents, they realized a return of more than 31 percent in one year. Another group built a 7,000-head feedyard in Bowman County. Other producers will earn a premium of up to 3 cents per pound for cattle that meet processing specifications of a new local processing company. More than 220 producers attended extension

feedlot schools in the last two years. Lenders are exploring additional financing of cattle, feed and cattle feeding facilities in North Dakota. One participant estimated that better health practices, bunk management and feeding practices cut his cost of gain by up to 5 cents per pound.

Source of federal funds: Smith-Lever

Scope of impact: Multi-state integrated extension and research, KS, MT, SD, MN, WI and WY

Key Theme - Agricultural Competitiveness: Leadership and economic development

Through a series of hands-on leadership development classes, cattle producers developed business plans for economic development opportunities. Cattlemen then explored implementing the plans and assessed community and economic feasibility. Through continued extension facilitation and guidance and informational assistance, business plans, financing packages and equity drives and management strategy were developed for cooperative cattle feedlots, a limited liability partnership that owns cattle for custom feeding, a cattle financing cooperative, a limited liability company for owning 60 percent of a local meat processing plant with sole source delivery rights, and a meat slaughtering and marketing 'c' corporation. Producers involved in the program have emerged as directors and managers of the proposed plans.

Impact: Cattle producers in central North Dakota realized that working as a group would provide more economic development than could be accomplished individually. Through educational sessions and continued facilitation and instruction, producers were able to develop several new vertically integrated cattle business ventures. The cooperative cattle feedlot plan has constructed a 7,000-head cattle feedlot located in a cow-calf region where feed grains are traditionally low-priced. The limited liability partnership that owns cattle for custom feeding has returned a 23.5 percent return on equity during a one-year period for 23 cattlemen involved. Other cattle feeding alliances have been developed as limited liability partnerships (LLP) and limited, limited liability partnerships (LLLP).

A cattle financing cooperative was developed for local producers and now provides financing for 95 percent of the calf purchase price with low-interest notes. The finance cooperative has grown 25 percent per year for cattle financed. Fifty-six cattle producers wanted to develop an outlet for supplying finished cattle at a 10 percent added-value premium and then developed a limited liability company as an investment vehicle for owning a majority of the processing company. These producers then recruited a partner under a corporation for construction of the harvesting and processing facility and development and marketing of a processed meat product line for a national ethnic market and regional high quality beef market.

Source of federal funding: Smith-Lever

Scope of impact: Multi-state extension. Cooperative feedlot owners are from ND, MT, SD and WY. Financed cattle are marketed to IA, SD, NE and MN. Processed meat products have markets in ND, MN, WI, SD, CA, IL, MI, NJ, NY, LA, CO, IA and internationally.

Key Theme - Adding Value to New and Old Agricultural Products: Dakota Heritage Beef

Two surveys and a focus group were conducted for Dakota Heritage Beef, a group of southwestern North Dakota and northwestern South Dakota ranchers. The purpose of the first survey was to determine consumer interest and potential for a test market in a branded beef product. The second survey was to gauge consumer satisfaction of their purchase. Important findings included: Survey 1, 1- Consumers indicated they were interested in buying locally produced beef (64.3 percent would pay a premium), 2- Quality was more important than price as the determining factor in buying beef (85.8 percent). Survey 2, 1- 77.4 percent of the survey respondents found the product through in-store promotions. 2- 91.1 percent were interested in future purchases. Producers are considering purchasing shares in a multi-state beef processing cooperative.

Impact: Consumer willingness to pay for locally produced food products is an important element in determining the feasibility of value-added ventures. Impacts of the survey indicate further analysis is warranted in determining the feasibility of facilities for producing branded beef product.

Source of federal funds: Smith-Lever

Scope of impact: State specific

Key Theme - Animal Production Efficiency: Improving the Reproductive Performance of Livestock

Reproductive performance of farm animals is a major limiting factor in efficient production of meat animals. NDSU researchers are studying the growth and development of the blood vessels in ovarian tissues to develop improved methods of superovulation in cattle and sheep. They are also evaluating the role of placenta size and blood vessel growth in fetal growth and development in cattle and sheep.

Impact: Results of the studies will lead to improved methods of regulating ovarian function, of obtaining large numbers of high-quality embryos for use in embryo transfer programs and of optimizing placental function and fetal growth in livestock. These improvement will give livestock producers tools to improve the reproductive management of their animals.

Source of federal funds: Hatch

Scope of impact: Multi-state research

Key Theme - Rangeland Management: Evaluating the Effects of Drought and Grazing on Rangeland

Grasslands of the Upper Great Plains region are important to the well-being of the livestock industry and wildlife populations. While producers cannot control drought, they can change livestock management to temper the impacts of drought. NDSU researchers are using automated rainout shelters to simulate drought on mixed grass prairie.

Impact: Researchers found that heavy grazing leads to declines in herbage biomass, root biomass and randomness in distribution of forb populations. Moderate grazing intensity appears to maintain rangeland ecosystem functioning and range condition. Additional research will build on early findings to provide recommendations for producers.

Source of federal funds: Hatch

Scope of impact: Multi-state research, SD and MT

Key Theme - Animal Production Efficiency: Development of Nutrition Programs to Enhance Dairy Production

The success of replacement heifer programs is measured in terms of efficiency of body growth, and more importantly, the milk-yield potential of the heifer. The capacity to produce milk in turn is largely influenced by the degree of mammary development and life-long lactation performance. NDSU researchers developed a stair-step nutrition regimen that boosts mammary development and life-long lactation performance. Research continues to refine the strategy and to apply it to other livestock such as beef cattle.

Impact: Results indicate the nutrition regimen will improve efficiency of heifer growth, boost lactation performance by at least 10 percent and extend lactation performance by more than two lactations. The regimen also promises to improve reproductive performance and health for first-calf heifers.

Source of federal funds: Hatch

Scope of impact: Multi-state research

Key Theme - Bioterrorism: Preparing for Biological Terrorism

In conjunction with the State Veterinarian's office, a plan of action was implemented to raise the awareness of veterinary practitioners about homeland security and then develop the concept of the North Dakota Reserve Veterinary Corps.

Homeland security and more specifically biological terrorism are real threats for an agriculturally based state like North Dakota. As a continuation of efforts initiated in 1998, the office of the extension veterinarian helped to plan, coordinate and deliver a bioterrorism preparedness and response training initiative for veterinary practitioners within North Dakota. Corrie Brown, an internationally acclaimed foreign animal disease researcher and speaker, in

conjunction with the extension veterinarian and state veterinarian, gave presentations regarding diseases, outbreaks and current response capabilities.

Impact: Because of the interest by the participants in the program, a North Dakota Reserve Veterinary Corps was initiated. Planning was conducted in 2002 for implementation in 2003. The primary idea was to train veterinary practitioners in the use of laptops, GPS units and digital photography to be able to investigate unusual cases rapidly and send those findings electronically to any expert in the world for consultation and verification. This is a model program for the nation. No other state has implemented such a corps.

Source of federal funds: Smith-Lever

Scope of impact: Multi-state extension

Key Theme - Animal Production Efficiency: Feed utilization

Animal feed utilization studies have focused on cattle, sheep and hogs. In addition to productivity realized by traditional, co-product and new feed regimes, considerable attention has been directed at sources, intake and fates of metabolizable protein.

Impact: Researchers have found that reducing degradable protein and increasing undegradable protein can decrease cost of production by more than 5 percent. They found that potato processing waste is 50 to 80 percent of the value of corn in finishing cattle diets, but can cut the cost of production depending on the price of corn. In similar research, scientists found that bread byproducts are 110 to 125 percent of the feed value of corn and can reduce the cost of beef production. The co-product value to beef cows in the North Dakota Central Crop Reporting district alone is approximately $9 million.

Researchers found that bison bulls gained best at 13.9 percent crude protein in the first study to establish protein requirements for bison bulls.

In other work, nutritionists found that beef cows fed low-quality hay respond to protein supplements during gestation and lactation and the form of protein is less important than its presence in the diet. Feeding weather-sprouted grains adds 50 cents to $1 to the value of a bushel of grain and captures several million dollars in revenue for North Dakota farmers and ranchers.

Source of federal funding: Hatch and Smith-Lever

Scope of impact: Statewide research and extension

Key Theme - Rangeland/Pasture Management: Renewable Resources

An integrated extension and research program was developed to improve rangeland management

across the state. Key components of the effort included:

Extension–

* A cow/calf and 12-month grazing and forage planning workshop (two- and three-day): Six intensive grazing, forage and livestock management sessions were held in Minot, Napoleon, Dickinson, near Amidon, and Ellendale, N.D., and near Gettysburg, S.D., for livestock producers. Ranchers learned to improve their rangeland management skills, develop year-long forage use strategies, and improve overall management of their beef herd.

* One-day range management workshops were conducted at 17 locations in North Dakota. These one-day programs are designed to introduce ranchers, farmers, conservationists, and youth range management principles that can enhance grazing management, conservation programs, and economic efficiency.

* Educating youth on the importance of the range resource: A four-day range youth camp was conducted in western North Dakota for youth interested in the range resource and range judging. Youth learned the importance of range to livestock producers, the environmental community, and wildlife enthusiasts. They learned basic fundamental range management practices and how to judge the resource for health and value for forage and wildlife habitat.

* Conduct two-day needs assessment for natural resource management on tribal lands in North and South Dakota: These assessments were conducted at Fort Berthold and Sitting Bull, N.D., and Pine Ridge, S.D., and concentrated on local ranchers and farmers, professionals in the region, and students at the colleges.

* Conduct 2 three-day in-service training sessions for North and South Dakota extension agents/educators and North and South Dakota Natural Resource Conservation Service conservationists. Thirty-six educational professionals (Extension agents and NRCS Staff) in North and South Dakota were taught using class room and field activities under a sustainable agricultural program for western rangeland.

Impact: 115 ranchers participated in the cow/calf and 12-month forage planning workshops. These six workshops impacted 235,250 acres of native rangeland, pastureland, and hayland and 34,417 cattle. More than 60 percent of the participants were planning to add new range improvement practices or cattle nutritional programs and more than 90 percent planned to implement some of the training strategies learned in the workshops.

One-day range and forage management workshops were conducted for 834 participants in North Dakota and bordering counties of South Dakota and Montana. These programs were designed to introduce ranchers, farmers, land managers, and youth to proper resource management tools and management strategies to improve efficiencies of the land base. The producers were then introduced to the more intensive two- or three-day workshops that would concentrate on their land base.

Twenty-three youth ages 13-18 participated in the four-day range camp and more than 105

participated in the State Range Judging Contest. We believe any involvement of youth in the importance of the range resource and fundamental needs for managing these lands will create a better-rounded adult.

Fifty-one people participated in the needs assessment sessions associated with tribal lands on Fort Berthold and Standing Rock reservations in North Dakota and Pine Ridge Reservation in South Dakota. Twenty-one professionals who work on the reservation, 10 ranchers/farmers, and 20 students and Elders participated in these needs assessment. These assessment programs were developed to help guide us in developing educational programs, demonstration projects, and research projects on tribal lands in North and South Dakota. Results of these assessments indicate a need for natural resource educational material and programs to enhance use for small and mid-size ranchers and farmers. A needed to be more sustainable on the Tribal lands and using their commodity products within the Tribal areas more effectively. A better understanding and marketability of bison and the natural resources well addressed as well.

County agents/educators and Natural Resource Conservation Service staff participated in two three-day sustainable agricultural programs. These programs educated these professionals on range management, livestock nutritional needs, range habitat assessment, and mentor development. This program was a 2-year project that finished in 2002.

Research -

*NDSU Extension Service in cooperation with the Animal and Range Sciences Department and Hettinger Research Extension Center has conducted three nutritional studies in western and south central North Dakota. This research has recognized nutritional composition and mineral status of 36 different grass varieties (20 cool-season and 16 warm-season grasses).

Impact: These results will allow forage growers, livestock producers, and wildlife managers to selected one or more grasses that fit their needs and goals, which should provide a more economically efficient operation. They can select a grass that fits a specific program and problem area. Example: if livestock producers need to add spring and fall pastures and a summer haying field, they can select a grass that fits each specific need while providing nutrients and forage at optimal levels (meadow brome “Regar” for spring, switchgrass “Forestburg” for summer hay ground, Russian wildrye “Mankota” for fall use while complementing the native pasture for summer grazing). Mineral status was also determined for native prairie with overwhelming results showing copper deficiencies during the entire growing season, zinc deficiencies in many years after mid July, phosphorus deficiencies by early July on all rangelands except lowlands associated with adjacent uplands, and potassium deficiencies after mid September. We also know calcium and iron are adequate during the entire growing season, and potassium is high until mid-September.

*Effects of sheep grazing using a multi-species and single-species grazing approach on leafy spurge infested rangeland: NDSU Extension Service, in cooperation with the Animal and Range Sciences Department and Hettinger Research Extension Center have conducted grazing trials on leafy spurge infested rangeland throughout North Dakota.

Impact: Sheep effectively controlled leafy spurge after one year using a single species grazing approach and after three years using a multi-species grazing approach. Leafy spurge stem densities were reduced by 96 percent and 92 percent on single-species and multi-species grazing treatments, respectively, after six years. Season long grazing using a multi-species approach provided a quicker, more efficient grazing of leafy spurge than rotational grazing; however, both reduced leafy spurge stem densities by 94 percent and 82 percent, respectively, after six years. The research provides new options for North Dakota livestock producers who want to control this invasive weed. Chemical control on large patches of the weed is seldom cost effective. The research shows that sheep can provide some financial return while providing control.

* Effects of dormant season grazing on native rangeland in western North and South Dakota: NDSU Extension Service, in cooperation with the Animal and Range Sciences Department and Hettinger Research Extension Center has conducted grazing trials on western rangelands in North and South Dakota.

Impacts: Dormant season grazing (mid November through mid January) at moderate and full use did not effect herbage production the following compared to standard full use summer grazing (June 1 through November 1). Double use of two weeks grazing in mid June followed by dormant season grazing from mid November through mid January enhance subsequent years herbage production by 26 percent. These results are from years 1 and 2 of a projected 10-year study. Initial results would indicate ranchers and land managers could graze their winter pastures
for two weeks in June at 50 percent use of standing herbage and fully graze (50 percent) the dormant season forage and enhance subsequent year's growth.

Source of federal funds: Smith-Lever and Hatch

Scope of Impact: Multi-state Integrated Research and Extension, ND, SD, MT, WY

Program 1

Allocated Resources

($ x $1,000)		**FY02**
1862 Extension ($)	Smith-Lever	952
	State	1,360
	FTE	34
1862 Research ($)	Hatch	1,428
	State	2,100
	FTE	42

Program 2

Allocated Resources

($ x $1,000)		**FY02**
1862 Extension ($)	Smith-Lever	378
	State	540
	FTE	13.5
1862 Research ($)	Hatch	245
	State	360
	FTE	7.2

Goal 2: A Safe and Secure Food and Fiber System

***Overview**: North Dakota and the United States have seen an increased awareness of food safety issues. Food prepared in institutional or restaurant settings has the potential for large-scale outbreaks of foodborne illness.*

At the same time, North Dakota agricultural producers play a key role in supplying food for the nation and world. Efforts to safeguard that food supply by protecting crops are an important function of NDSU research and extension.

In the past seven years, more than 1,700 food service managers and employees from restaurants, nursing homes, hospitals, daycare centers and schools in over 100 different North Dakota cities have attended NDSU Extension Service food safety workshops. The workshops focus on the Hazard Analysis and Critical Control Point (HACCP) approach to food safety that was developed by NASA to ensure safe food for its astronauts. Over 100 managers have been certified through the National Restaurant Association's ServSafe Certification Program. In follow-up surveys, 65.9 percent reported they washed their hands more often when preparing food, 65 percent had shared the workshop materials with other people, 57 percent reported using
food thermometers more often, and 43.5 percent had changed their cooling practices to use ice baths or smaller containers.

After a food safety education program aimed at teens, more than 84 percent reported washing their hands more often when preparing food, 66.4 percent were more careful about cleaning and sanitizing, 58.4 percent had shared their knowledge about food safety with other people, 25.7 percent reported checking their refrigerator or freezer temps at home more often, and 31 percent reported thawing foods in the refrigerator or microwave. About 19.5 percent reported using a food thermometer to measure the temperature of food more often and 36.3 percent had applied what they learned when preparing food for the public. Following the pilot project, about 90 letters were sent to foodservice/restaurant managers in the sites where training had taken place alerting them of the training that youth in their communities had completed and encouraging them to ask youth applicants if they had been part of the program. At least one business provided an additional monetary incentive to students who had completed the training. The project served as pilot for a USDA-funded grant project, which will expand the training statewide.

NDSU developed the first multi-disciplinary minor in food safety. Thus far, every student completing the food safety minor who wanted a job in food safety has obtained one. Details of the program have been disseminated to educators nationwide, and cooperative efforts with several major institutions are under way to expand the impact of NDSU's program, including its undergraduate and graduate offerings. Other institutions are using NDSU's experiences as a model of an educational initiative designed to respond to our stakeholders' needs in minimal time. Nearly 100 former NDSU students expressed interest in pursuing a PhD in the area, and several students are currently enrolled in the food safety graduate programs. Additionally, several companies and agencies have expressed substantial interest in participating in these

programs or have actively recruited its graduates.

Insects can be a serious threat to crops and the food supply. Sunflowers are one example. For example, in 2001, roughly 70 percent of sunflower heads surveyed in North Dakota had some damage
by caterpillars, predominantly the banded sunflower moth, presumably resulting in significant decreases in seed yield. NDSU researchers are developing specific attractants for female moths that could provide season-long protection for the crop by luring the pests away from the crop, interrupting their breeding behavior or drawing them to traps.

Crop diseases are another threat and in North Dakota, Fusarium head blight is one of the biggest threats to the wheat crop. Based on NDSU research and extension efforts, producers utilized fungicides as a management strategy on 800,000 acres of wheat and realized an average return of $35 per acre, resulting in an additional $28 million revenue to producers who used this strategy in 2000 and 2001. In 2002, use of the fungicide on 80,000 acres resulted in an additional revenue of $2.8 million.

Another approach to protecting crops from diseases and pests is to develop crops with natural resistance. Teams of NDSU plant breeders, plant pathologists, entomologists and others are working on pest and disease-resistant varieties of wheat, corn, sugarbeet, potato, barley and other crops.

Natural enemies of pests can also be a powerful ally in protecting the food supply. Leafy spurge is a prolific and tough weed infesting millions of acres of western rangeland. NDSU researchers have been instrumental in identifying and distributing insects that feed exclusively on the weed. Biological control of leafy spurge in North Dakota is expected to be valued at $58 million per year by 2025 by restoring thousands of acres of rangeland to productivity and by reducing herbicide costs. Once established, biological control of leafy spurge and other pests will provide self-sustaining control without further input cost to the grower.

NDSU researchers are also working to protect food and consumers once food products are harvested. Researchers developed computer vision and tactile sensing technology to capture images of beans, sunflowers and French fries. Prototype systems were developed to evaluate quality characteristics such as good, moldy and rancid sunflower kernels. The technology also evaluated oil and moisture content with 96 percent accuracy. The research shows production and distribution of high-quality food and agricultural products can be achieved by the use of objective consistent, accurate and non-destructive quality evaluation systems. They are also developing miniature sensors to detect food spoilage and biological and chemical toxins.

Key Theme - Food Safety Consumers

Despite widely publicized foodborne illness outbreaks associated with undercooking foods, particularly ground beef, only 6 percent of consumers "sometimes" or "always" measure the temperature of burgers with a food thermometer (USDA-FSIS). Research has shown that color of meat does not ensure that it has reached a safe internal temperature. The purposes of the

"Thermy Project" were to develop culturally appropriate lessons, evaluation tools, posters and handouts based on the national "Thermy" campaign to promote use of food and refrigerator thermometers; to pilot test the materials on a reservation; and to increase the monitoring of final cooking temperatures and food storage temperatures among Native American families. Educational sessions were conducted and thermometers were distributed at commodity food distribution sites, senior centers, Head Start centers and in Women, Infants and Children (WIC) offices. Follow-up classes were conducted at least one month after the initial training and refrigerator thermometers were distributed. The materials were also used in statewide programming targeting limited income audiences through the EFNEP/FNP programs.

Impact: More than 2,800 consumers have participated in food safety educational efforts with the goal of increasing home food thermometer use. The participants reported preparing food for groups vulnerable to foodborne illness, including infants/young children (65 percent), seniors/elderly (42 percent), pregnant women (12 percent) and immune-compromised individuals (5 percent). About 99 percent of the participants reported preparing food at home for themselves or others at least once per week, with 60 percent reporting preparing food at home seven or more times weekly. About 96 percent said they planned to use the food thermometer they received. About 58 percent participated in a follow-up class and survey. Ninety-three percent correctly identified the recommended internal cooking temperature for ground beef as 160 degrees or higher, 90 percent identified using food thermometers as a way to help prevent foodborne illness and 80 percent reported that they were feeling more confident they were serving safe food to their families as a result of using a thermometer. About 70 percent reported they had used their thermometer in the previous month, and 93 percent planned to use the refrigerator thermometer they received.

Source of federal funds: Smith-Lever

Scope of Impact: Statewide Extension

Key Theme - HACCP: Foodservice

Increases in daycare, hospital and nursing home populations as well as a growth in restaurant and deli businesses means a growing portion of the population is at risk from outbreaks of foodborne illness. In addition, quantity food preparation presents unique challenges for safe food handling and preparation. In this environment, government regulation is demanding more attention to the development of food safety practices. As a result, there is high demand for training and educational materials in food safety. The National Restaurant Association estimates that a single outbreak of foodborne illness will cost a restaurant at least $75,000.

In the past seven years, more than 1,650 food service managers and employees from restaurants, nursing homes, hospitals, daycare centers and schools in over 100 different North Dakota cities have attended NDSU Extension Service food safety workshops held through the state. The four- to six-hour workshops focus on the Hazard Analysis and Critical Control Point (HACCP) approach to food safety that was developed by NASA to ensure safe food for its astronauts. In addition, the National Restaurant Association's ServSafe certification program has been

implemented in North Dakota food safety workshops.

Impact: On follow-up surveys, 99 percent rated food safety as something "very important" to them. About 74 percent reported telling other people about what they had learned, 65 percent had shared the workshop materials with other people, 57 percent reported using food thermometers more often, and 43.5 percent had changed their cooling practices to use ice baths or smaller containers. About 98 percent of the managers who completed the ServSafe Certification training received passing scores.

Source of federal funds: Smith-Lever

Scope of Impact: Regional Extension

Key Theme - Food Safety: Teens

A five-lesson food safety curriculum was developed and piloted in classrooms for students ages 15 to 19 in four schools in two cities. More than 300 students completed the lessons and passed the exam. Average test scores increased from 59 percent on the pre-test to 96 percent correct on the post- test. The follow-up test score average was 93 percent, indicating good retention of the facts they learned. About 90 percent rated serving food safely as "important" or "very important" to them. About 71 percent had been involved in food preparation for the public; of those, about 24.6 percent of the students had been involved in food preparation for the public as a volunteer (4-H, etc.), 38 percent had worked in a restaurant and 18 percent had been involved in another type of food service.

Impact: On the follow-up survey, over 84 percent reported washing their hands more often when preparing food, 66.4 percent were more careful about cleaning and sanitizing, 58.4 percent had shared their knowledge about food safety with other people, 25.7 percent reported checking their refrigerator or freezer temps at home more often and 31 percent reported thawing foods in the refrigerator or microwave. About 19.5 percent reported using a food thermometer to measure the temperature of food more often and 36.3 percent had applied what they learned when preparing food for the public. Following the pilot project, about 90 letters were sent to food service/restaurant managers in the sites where training had taken place alerting them of the training that youth in their communities had completed and encouraging them to ask youth applicants if they had been part of the program. At least one business provided an additional monetary incentive to students who had completed the training. The project served as a pilot for a USDA-funded grant project, which will expand the training statewide.

Source of federal funds: Smith-Lever

Scope of Impact: Regional Extension

Key Theme - Food Safety: Children

According to the Centers for Disease Control and Prevention (CDC), hand washing is the single most important means of preventing the spread of disease. Studies in schools and childcare centers have shown links between improper or infrequent hand washing and colds, flu and food borne illness outbreaks.

About 1,300 children in grades K-6 in schools throughout North Dakota have participated in a hand washing education using a fluorescing dye and light to show where they frequently miss. The students were provided a handout showing a hand and asked to mark the spots they missed washing (where the dye remained). Fingertips, back of hand and wrists were commonly missed areas.

Impact: Among sixth-graders, 45 percent reported they didn't wash their hands before they ate and 32 percent reported they always use soap. About 98 percent of the students correctly identified 20 seconds as the current recommendation for time spent washing hands. About 90 percent of the participants planned to wash their hands more carefully in the future. Teachers reported that children were spending more time washing their hands, and many were singing the "ABC Song" as they washed.

Source of federal funds: USDA

Scope of Impact: Statewide Extension

Key Theme - Human Nutrition: Food Safety

The EFNEP Program focuses on increasing the ability of families receiving food stamps to make wise use of their food dollars. This is accomplished by providing classes to low-income resource audiences on nutrition and meal planning; food purchasing, preparation, and safety; and food resource management.

Impact: Staff received training on the food safety. Participants in the food safety classes received food thermometers to insure ensure proper cooking temperature of their food. Follow-up evaluations show:

- 57 percent of homemakers showed improvement in one or more of the food safety practices such as thawing and storing foods properly.
- 60 percent of participants at entry into the EFNEP program demonstrated acceptable food safety practices. At the end of the program, 89 percent of the participates participants demonstrated acceptable food safety practices.

Source of federal funds: Smith-Lever

Scope of impact: Six counties, four of the sites are located at tribal reservations.

Key Theme - Human Nutrition: Food Resource Management

One of the overall goals in the area of food resource management for the past year was to help clients manage their food budget. Staff used the new curriculum developed by the University of Wisconsin entitled Money for Food.

Classes are often held at a variety of cooperating agencies such as tribal organizations, WIC, or Head Start.

Impact: North Dakota residents attended food resource management programming. Participants
defined a variety of means to help them effectively manage their limited resources. Surveys show:

- 76 percent of homemakers showed improvement in one or more food resource management practices, such as plans meals, compares prices, does not run out of food or uses a grocery list.
- 21 percent of the participants at entry level demonstrated acceptable practices of food resource management, compared to 46 percent at the end of their series of classes.

Source of federal funds: Smith Lever

Scope of impact: Six counties, four of the sites are located at tribal reservations.

Key Theme - Human Nutrition: Expanded Food and Nutrition Education Program

The Expanded Food and Nutrition Education Program (EFNEP) teaches limited-resource audiences how to improve their dietary practices and become more effective managers of available food budget resources. The nutrition education assistant (NEA) helps families to increase knowledge of the essentials of human nutrition, helps in their ability to select and buy foods that satisfies nutritional needs and improve practices in food production, preparation and food safety.

Impact: A variety of delivery methods are used to improve nutrition practices in each of the six counties where we reach adults and youth through EFNEP education. Evaluations show 87 percent of homemakers showed improvement in one or more nutrition practices such as plans meals, makes healthy food choices, prepares foods without adding salt, reads nutrition labels or has children eat breakfast.

Source of federal funds: Smith-Lever

Scope of impact: Six counties, four of the sites are located at tribal reservations.

Key Theme - Food Security: Undergraduate and Graduate Education in Food Safety

NDSU, along with the USDA HEP, developed a unique educational experience for undergraduates. Four new courses in food safety and a minor program of study in food safety were developed and implemented. In addition, the Great Plains Institute of Food Safety was established. More recently, the institute's educational offerings were expanded to include a major, an M.S. and Ph.D. degrees in food safety and a Graduate Certificate in Food Protection, making NDSU's food safety educational efforts among the most comprehensive in the country.

Impact: Thus far, every student completing the food safety minor who wanted a job in food safety has obtained one. Details of the program have been disseminated to educators nationwide, and cooperative efforts with several major institutions are under way to expand the impact of NDSU's program, including its undergraduate and graduate offerings, beyond regional borders using distance education. In addition, we have offered our experiences to others as a model of an educational initiative designed to respond to our stakeholders' needs in minimal time. Also, our experiences demonstrate the incorporation of experiential learning into a multidisciplinary curriculum in order to develop the problem-solving abilities of our students. Finally, this program is being used to demonstrate the development and implementation of a complex, multidisciplinary curriculum by a team of faculty from widely different backgrounds. Nearly 100 former NDSU students expressed interest in pursuing a Ph.D. in the area, and several students are currently enrolled in the food safety graduate programs. Additionally, several companies and agencies have expressed substantial interest in participating in these programs or have actively recruited its graduates.

Source of federal funds: USDA Challenge Grant (now expired) and institutional funds

Scope of impact: Regional and national impact. Current distance educational initiatives with South Dakota State University, Michigan State University and University of Minnesota should greatly extend the reach of the program.

Key Theme - Food Security: Protecting Potato through Pest Resistance

Crops resistance to insect and plant pathogenic pests is an integral component in sustainable agriculture production. A team of scientists from entomology, plant sciences and pathology are researching potato resistance for managing the green peach aphid (GPA) and a virus vectored by GPA, potato virus Y (PVY). PVY infections have resulted in rejection rates at 30-40 percent of certified seed potato fields and the decline of seed potato production in the Red River Valley of North Dakota and Minnesota. Germplasm derived from Solanum etuberosum, a wild potato, is a potential source of resistance to PVY as well as its vector GPA.

Impact: A high incidence of PVY in potatoes has a great impact in North Dakota where the state ranked sixth in the United States in potato production during the 2001 production season. Nearly 40 percent of the U.S. supply of seed potatoes has been derived from North Dakota and Minnesota. However, rejection rates of 37.7 percent, 32.3 percent and 31.6 percent of certified seed fields from 1999 to 2001 have resulted in the decline of seed potato acreage in the Red River Valley.

Source of federal funds: Hatch

Scope of impact: Multi-disciplinary (entomology, plant sciences and plant pathology) research. The seed potato industry will benefit from virus resistant potato cultivars, restoring the Red River
Valley of North Dakota and Minnesota as a leading supplier of seed potatoes to the major potato producing states.

Key Theme - Food Security: Breeding North Dakota Spring and Durum Wheat for Resistance to Wheat Midge

Spring wheat. Dr Berzonsky has produced double haploids from crosses between North Dakota spring wheats (e.g. Argent, Parshall, Reeder) and the two resistant spring wheat lines, BW-277 and Key 24-97, obtained from AgCanada. The two resistant lines contain the same resistance gene. The remnant seed of these 27 double haploid lines will be tested in the greenhouse for resistance to the wheat midge.

Durum Wheat. After we found little or no resistance in the durum wheat genotypes that were field-tested in 2001 and 2002, 14 durum lines representing the F3 generation of crosses for incorporation of the resistance gene were obtained from AgCanada. The seed will be increased and tested for wheat midge resistance in the greenhouse. If increased seed is ready for a summer field trial, Dr Elias will incorporate it into his field tests, hopefully in an area in which wheat midge populations are significant.

Other R genes? In Britain, a research group at Rothamstead has found a resistance trait that appears similar to the resistance conferred by the R gene identified by AgCanada i.e. the larvae is unable to feed on the kernel and dies within five days of attack. The trait was found in a wheat genotype from France. We have made contact with this research group and have expressed our desire to collaborate with them to see if this resistance trait is the same as the Canadian gene. Interestingly, this group is also developing a monitoring system using the sex pheromone of the wheat midge. The wheat midge has been a serious pest in England since 1993.

Ancestral wheats? We have recently started collaborating with a cytogeneticist, Dr. Stephen Xu (USDA, Fargo), to test his wheat-wheatgrass amphipods, alien addition lines, durum-dicoccoides substitution lines, etc. for resistance to wheat midge. Collaboration is also possible with Xiwen Cai, the wheat cytogeneticist recently hired by the NDSU Plant Science Department.

Phenotypic markers for resistance? We have recently started research to determine precisely how the wheat midge feeds on the developing wheat kernel and how wheat genotypes carrying the Canadian resistance gene defend the wheat kernel against this wheat midge attack. For these studies, we are collaborating with Dr. Tom Freeman of the NDSU/USDA Microscopy Lab. This greater understanding of the phenotypic response associated with the Canadian resistance gene hopefully will provide us with an additional tool for identifying new resistance traits.

Impact: In the last decade, the wheat midge has emerged as a serious pest of durum and hard red spring wheat grown in North Dakota. Management practices including early planting, scouting and insecticide treatments have mitigated the impact of the pest somewhat, but the best long-term solution is the introduction of midge-resistant wheat varieties. Multiple sources of that resistance would help prevent mutations or adaptations that might help the pest overcome resistance. When scouting reveals infestation, producers spend an estimated $10 per acre to control the pest, a cost that would be all but eliminated by the introduction of resistant varieties.

Source of federal funds: Hatch

Scope of impact: Multi-state research MN, SD and Canada

Key Theme - Food Security: Preventative Pest Management

The sunflower crop is beset by a multitude of insect pest problems. Frequently, outbreaks of one or more of these pests can be disastrous for the crop in localized areas. Because it is highly desirable to develop new environmentally friendly, sustainable controls for insect pests in agriculture, we are identifying and developing chemical attractants for sunflower pests. We have isolated a number of chemicals produced by sunflower heads that attract female banded sunflower moth to lay eggs on sunflowers. Behavioral tests are currently being conducted to define the most attractive blend of chemicals. This will be tested in field trials as a method for controlling banded sunflower populations

Impact: Insects can have very significant impacts on the sunflower crop. For example, in 2001, roughly 70 percent of sunflower heads surveyed in North Dakota had some damage by caterpillars, predominantly the banded sunflower moth, presumably resulting in significant decreases in seed yield. Development of specific attractants for female moths could provide season-long protection for the crop.

Source of federal funds: Hatch

Scope of impact: Sunflowers are grown extensively throughout the mid-central states. This research is of potential benefit to sunflower growers from Manitoba to Texas.

Key Theme - Food Security: Biological Control

Research is focused on development and optimization of application methodology for delivery of the insect-pathogenic fungus, Metarhizium anisopliae, to control the sugarbeet root maggot. Additional work is aimed at developing an integrated system that combines the use of Metarhizium with cover cropping, a cultural practice shown in previous NDSU research to provide protection from sugarbeet root maggot feeding injury.

Impact: The sugarbeet root maggot is the most serious insect pest of sugarbeet in the Red River Valley of North Dakota and Minnesota. For nearly 20 years, producers in the north central and

western United States have relied on chemical insecticides with the same mode of action for controlling the sugarbeet root maggot. Therefore, the potential threat of insecticide resistance development is a major concern, and alternative control materials are needed. Bio-based control materials that can be applied via conventional equipment would provide a readily adoptable alternative to traditional control that typically involves the use of chemical insecticides.

Source of federal funds: Hatch

Scope of impact: Multi-state integrated research and extension. This insect is a major pest in over two-thirds of the sugarbeet growing areas of the United States. Growers in ND, MN, CO, ID, MT, NE and WY are likely to benefit from this program.

Key Theme - Food Security: Preventive Pest Management

The development of cultural strategies for management of agricultural pests is a worthy endeavor given that chemical insecticides are under frequent regulatory scrutiny and have the potential for causing harmful impacts to non-target and beneficial organisms in the agroecosystem. Research is under way on use of the trap crop concept for protection of fields from losses because of feeding by the sugarbeet root maggot.

Impact: The sugarbeet root maggot is capable of causing yield losses of between 40 and 100 percent in the absence of control measures. Development of cultural means for controlling this important sugarbeet pest could potentially allow for major reductions in chemical pesticide use.

Source of federal funds: Hatch and Smith-Lever

Scope of impact: Multi-state integrated research and extension. This insect is a major pest in over two-thirds of the sugarbeet growing areas of the United States. Growers in ND, MN, CO, ID, MT, NE and WY are likely to benefit from this program.

Key Theme - Food Security: Genetic Resistance to Pests

Host plant resistance to insect injury is an attractive insect management strategy due to its direct benefits such as reduced applicator exposure to insecticides and low risk to nontarget organisms. Cultivated varieties of sugarbeet and wild accessions from the world Beta germplasm collection are being evaluated to identify native sources of host plant resistance to feeding injury from the sugarbeet root maggot. If successful, genetic material from these evaluations will be made available for incorporation into elite commercial lines.

Impact: The potential for insecticide resistance in sugarbeet root maggot populations, as well as the possible removal of conventional chemical insecticides from federal registration, provide a strong impetus for the development of cultural strategies to manage this key insect pest of sugarbeet. Extensive grower adoption of cultural means for controlling this pest could potentially allow for major reductions in the overall pesticide load in areas infested by the

sugarbeet root maggot.

Source of federal funds: Hatch

Scope of impact: Multi-state integrated research and extension. This insect is a major pest in over two-thirds of the sugarbeet growing areas of the United States. Growers in ND, MN, CO, ID, MT, NE and WY are likely to benefit from this program.

Key Theme - Food Security: Preventive Pest Management

Lygus bug (Lygus lineolaris) infestations have caused significant late-season injury in North Dakota and Minnesota sugarbeet fields in recent years. A two-tiered project is under way to characterize the seasonal activity and host sequence of Lygus populations in the Red River Valley, and to quantify the effects of feeding injury on sugarbeet yield and quality.

Impact: The economic impacts of this newly recognized sugarbeet pest are not well understood. However, tens of thousands of sugarbeet acres have been treated for its control over the past several years. This research will provide more concrete information to assist producers in affected areas with the pest management decision-making process. Specifically, the information gained in this investigation should help identify when control is justified and also prevent unneeded pesticide applications.

Source of federal funds: Hatch

Scope of impact: Multi-state integrated research and extension. This insect has been a problem for producers throughout the sugarbeet growing areas of eastern North Dakota and all of western North Dakota.

Key Theme - Food Security: Fusarium Head Blight in Wheat

Fusarium head blight (FHB or scab) is a major disease of spring wheat and durum wheat in North Dakota. An unprecedented epidemic of this disease occurred in eastern North Dakota in 1993, and severe outbreaks have occurred each year since 1993 throughout portions of the state, resulting in more than a $3 billion loss to North Dakota's economy over this time. As a result of these epidemics, producers in eastern North Dakota have sought alternative broadleaf crops, resulting in fewer spring wheat acres. Much of the durum wheat production has moved west in the state, an area traditionally drier and less susceptible to FHB than the east. However, in 2000 and 2001, severe outbreaks of FHB also occurred in north central and northwest North Dakota because of favorable weather for infection occurring during grain flowering. Yield losses in the region ranged from 10 to 90 percent and were especially severe in susceptible durum fields. Weather patterns were drier in 2002, so overall loss due to FHB was less, but individual fields in parts of the state still had severe damage. Fungicide trials established in the affected regions indicated that proper timing of an appropriate fungicide resulted in yield increases of 10-12 bushels/acre and corresponding increases in test weight and market grade. Economic returns

from use of the fungicides were between $33-$44 per acre, because of increased yields and associated improved quality factors. Extension specialists provided this information on fungicide results to growers via numerous county and regional meetings, demonstrations and news releases. The extension plant pathologist applied for a Section 18 emergency exemption for a specific fungicide with the best efficacy against the disease, and it was granted by EPA. The fungicide was applied to approximately 800,000 acres of wheat in 2000 and 2001, and on 80,000 acres in 2002. An average net return of $35 per acre was realized, after cost of fungicides and indirect and direct costs were subtracted from the gross return/acre.

Impact: Producers utilized fungicides as a management strategy on 800,000 acres of wheat and realized an average return of $35 per acre, resulting in an additional $28 million revenue to producers who used this strategy in 2000 and 2001. In 2002, use of the fungicide on 80,000 acres resulted in an additional revenue of $2.8 million. Producers were provided training on proper use of the fungicide and how this strategy should be integrated with other management strategies for optimum control of FHB.

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension. Wheat is the largest acreage crop in North Dakota and the value of production ranges from $500 million to $1 billion each year. The impact of this project affected producers throughout the regions of the state where Fusarium head blight occurred, and allowed producers a viable and economic option for helping control this potentially
devastating disease - getting yield and quality for their crop that could not be achieved without the use of the fungicide.

Key Theme - Food Security: Sclerotinia Disease Development in Sunflower

Sclerotinia is a major disease of broadleaf crops in northeastern North Dakota. Due to the increased acreage of susceptible broadleaf crops, this particular disease is becoming a greater problem over larger areas. For example, in the fall of 1999 wet weather resulted in statewide problems with Sclerotinia head rot disease of sunflower causing losses reaching 60 to 70 percent in some areas. The National Sunflower Association estimated losses in 1999 alone at $1 million. Especially hard hit were confectionary sunflower producers who produce seeds for human consumption and bird feed. Sclerotinia tolerance levels are very low for confection seed producers and if sclerotia bodies or damage to the seeds exceeds 3 percent, the field is rejected for human consumption. Producers in 1999 and 2000 were faced with the problem of what to do with highly contaminated confection sunflower seeds. Extension specialists worked with a group of farmers in north central North Dakota to determine if significant reductions in sclerotia contact could be obtained through harvest machine adjustments or in cleaning of the grain sample after harvest. Field studies in the fall determined that some techniques might reduce harvested sclerotia body content, but a more thorough cleaning with specialized equipment would be necessary to reduce sclerotia content, and to some degree dark seed content, in confection seeds. Information gathered in the study was ultimately compiled into an extension publication that was widely used in the fall of 2000 as this problem reoccurred. Additional

information on the biology and management of Sclerotinia in sunflower and other susceptible crops was made available in 2001 and 2002 via training sessions and via contributions to a CD-ROM provided to county and area agents for grower training.

Impact: Producers in the north central region who stored sunflower seed following best harvest practices were able to clean the seed and many producers were able to market clean loads that sold for contracted price of 13 cents per pound versus 5 cents per pound for bird seed or confection market. Producers were trained on the biology and management of Sclerotinia for sunflower and other susceptible crops.

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension. Sunflower is the fifth-largest seeded crop in North Dakota and the value of its production is greater than $20 million. The impact of this project affected producers throughout the north and east central parts of North Dakota as that is where the bulk of the confection sunflower seed is raised. The CD-ROM training provided by extension agents reached oilseed sunflower producers statewide.

Key Theme - Food Security: Biological Control

Natural enemies are an essential component of a sustainable farm ecosystems. A major research and extension effort involving the departments of entomology, plant science and animal and range sciences is under way to manage leafy spurge, a key weed pest of rangelands, that causes losses valued at $23.2 million per year in North Dakota. Insect predators of spurge are being evaluated for impact and adaptability to local environments and are being redistributed to speed their establishment and effectiveness. Interaction of insect natural enemies of spurge with possible spurge biotypes is being studied. Grazing animals such as sheep and goats are being incorporated in a management program with insect natural enemies and limited pesticide use to sustain leafy spurge populations at sub-economic levels. Biocontrol programs using predators, parasites and pathogens of insect pests such as banded sunflower moth, sunflower midge, sugar beet root maggot and Colorado potato beetle are under way. Sclerotinia, a major limiting disease of most broadleaf crops in the area, is targeted for control by several parasitic fungi. Basic research on the biocontrol of soilborne diseases is being conducted to find new ways of combating serious root diseases of crops such as Rhizotonia and Fusarium root diseases cause substantial losses and are difficult to control. Transformation with carboxin resistance was accomplished for BNR. Two of the transformants showed biocontrol activity.

Impact: Biological control of leafy spurge is expected to be valued at $58 million per year by 2025 by restoring thousands of acres of rangeland to productivity and by reducing herbicide costs. Once established, biological control of leafy spurge and other pests will provide self-sustaining control without further input cost to the grower.

Source of federal funds: Smith-Lever and Hatch

Scope of impact: Multi-state integrated research and extension. Growers in North Dakota and

the surrounding states benefit from the leafy spurge biological control program. Leafy spurge flea beetles are redistributed in ND, MN, WY, SD, NB and MT.

Key Theme - Food Security: Genetic Resistance to Pests

The identification of pest resistance genes, their characterization and genetic nature are major goals for research programs of insect and disease pests of a number of crops. Sources of resistance to the sunflower midge are being sought in existing sunflower germplasm and varieties. Improved methods to screen for resistance and to characterize the functional nature of sunflower midge resistance are being made. Fusarium head blight (FHB) caused disastrous losses in small grains in the Dakotas and Minnesota between 1993 and 2000. Plant pathologists and breeders developed testing programs for FHB and tested thousands of lines in the field and greenhouse programs. The NDSU released hard red spring wheat variety Alsen combines FHB resistance with other traits to reduce losses from the disease. This should significantly reduce losses due to FHB. The potato breeding program has a major objective of developing cultivars with late blight resistance. Several selections have been identified with good resistance to the new genotypes present in the United States. One objective of dry bean pathology is to identify new sources of resistance to rust and white mold for the bean breeding program and incorporate this resistance into new varieties. Incorporating disease resistance genes into soybean cultivars has major impact on improving soybean production and profitability for growers. Extensive research in this area is now producing soybean cultivars with disease resistance.

Impact: Genetic crop resistance to pests provides growers with a simple pest management tactic that works under conditions unfavorable to natural enemies and pesticides. Genetic crop resistance eliminates or reduces the need for other pest management inputs and reduces grower expense. Genetic crop resistance saves growers management time because of reduced need for monitoring of pest populations. The economic impact of the FHB resistant wheats should result in millions of dollars saved over growing FHB susceptible cultivars. This will also save huge amounts in reduced fungicide sprays. Late blight resistance in commercial potato production could save millions in reduced spray applications and improved yields. Resistance to rust and white mold in dry beans would be elimination of two of the major problems in the dry bean industry. Incorporating disease resistance in soybean cultivars has had a major impact on improving soybean production especially in the area of root rot.

Source of federal funds: Smith-Lever and Hatch

Scope of impact: Multi-state integrated research and extension. Growers in the tri-state area of MN, ND and SD and in Manitoba profit from resistance to pests in the major crops. Resistance to FHB alone is worth millions to cereal growers. In addition, breeders and pathologists have added resistance to important pests in the minor crops. Resistance to late blight would prevent, or reduce losses in storage as in 1999 where an estimated $99 million of harvested potatoes rotted.

Key Theme - Food Safety: Preventing Fusarium Growth and Toxin Production during the Malting of Barley

Fusarium infections in grains have been a persistent problem for the upper Midwest. These result in mycotoxin contamination of grain. Mycotoxins cause chronic and acute toxicoses in humans and animals. Infected grain also causes severe economic consequences because of lost income from discounted sales. During the malting process for barley, mold can begin to grow and produce more mycotoxins which survive kilning and remain biologically active. The malting industry has placed severe restrictions on the amount of mycotoxin in barley because of these concerns, resulting in a loss of income for producers as barley is diverted from malting to livestock feed.

Impact: NDSU researchers are studying physical treatments such as irradiation, steam and pressure to pasteurize barley. These physical treatments may prevent growth of mold during malting while not affecting other barley quality attributes.

Source of federal funds: Hatch

Scope of impact: Multistate research, SD, MT, MN and Manitoba

Key Theme - Food Quality: Influence of Storage Conditions on Soybeans for Tofu

Soybeans are stored on the farm or during shipping after harvest until they are processed for foods. Tofu is a key value-added soy food. Under certain environmental conditions, the food and nutritional qualities of soybeans deteriorate and lead to tremendous economical loss if they have reduced processing yield of tofu. NDSU researchers are studying the molecular and functional changes of soybeans stored under various temperatures and humidities to learn how these changes influence the texture, color and flavor of tofu products.

Impact: Results of the research will lead to a better understanding of the biochemical changes of soybeans during storage and will lead to suitable storage strategies to prevent quality losses.

Source of federal funds: Hatch

Scope of impact: Multi-state research

Key Theme - Foodborne Pathogen Protection: Determining Potential Foodborne Pathogen Risks from Bison

The American bison is a relatively new, emerging meat species gaining increased popularity in the United States and in European meat markets. Little is known about this meat type except that it is not subjected to the same growth promoting hormones or antimicrobials often used in the cattle industry. Therefore, these animals and their natural microbiological flora may not be subjected to the same selective pressures as seen elsewhere. Currently little is known of the

microbiological safety of bison meat.

Impact: In what may be the first study of the microbiological safety of bison meat, NDSU researchers will create a database of information on foodborne pathogens on this emerging meat species and lay the groundwork for future research. Ultimately, the research will lead to strategies for making consumption of bison meat as safe from foodborne pathogens as possible.

Source of federal funds: Hatch

Scope of impact: Multi-state research

Key Theme - Food Safety: Development of Intelligent Quality Sensors

NDSU researchers are exploring the potential of several types of state-of-the-art sensors that could detect food safety problems in real time. Such problems include microbial hazards, chemical hazards and natural toxins that enter the food supply. The long-term goal of the research is to develop miniaturized portable sensors that can provide information to users about the safety and quality of food and agricultural products. Researchers believe that the chemicals and gasses generated through fungal and bacterial metabolism of food products can be used as indicators of contamination or quality concerns.

Impact: Miniature, portable sensors could provide valuable information for researchers, retailers and consumers. Such sensors could provide instant indication of food quality and safety concerns.

Source of federal funds: Hatch

Scope of impact: Multi-state research

Key Theme - Food Security: Managing Field and Storage Diseases of Potatoes

NDSU researchers are studying four key storage and field diseases of potato: late blight, early blight, pink rot and ring rot. They will screen germplasm for resistance to the diseases and evaluate field and storage conditions and management techniques for their impact on disease occurrence and severity.

Impact: Results from the research will help the potato industry implement control measures that affect quality and quantity of fresh and processed potatoes. Control measures are targeted for diseases that affect fresh and stored potatoes and include resistant varieties, fungicides, cultural practices and biological control.

Source of federal funds: Hatch

Scope of impact: Multi-state research

Key Theme - Food Quality: Intelligent Systems for Evaluating Crops and Food Products

Quality evaluation and characterization of agricultural and food products are often inconsistent, subjective and involves the destruction of the products. This creates a problem in producing high-quality agricultural and food products consistently and accurately. NDSU research focuses on developing and evaluating intelligent computer-based technologies and sensors for objective and accurate non-destructive quality evaluation of agricultural and food products.

Impact: Researchers developed computer vision and tactile sensing technology to capture images of beans, sunflowers and French fries. Prototype systems were developed to evaluate quality characteristics such as good, moldy and rancid sunflower kernels. The technology also evaluated oil and moisture content with 96 percent accuracy. The research shows production and distribution of high-quality food and agricultural products can be achieved by the use of objective consistent, accurate and non-destructive quality evaluation systems.

Source of federal funds: Hatch

Scope of impact: Multi-state research

Allocated Resources ($ x $1,000)		**FY02**
1862 Extension ($)	Smith-Lever	1,036
	State	1,480
	FTE	37
1862 Research ($)	Hatch	615
	State	905
	FTE	19

Goal 3: A Healthy, Well-Nourished Population

Overview. *As reported in the Journal of the American Medical Association, the rate of overweight and obesity among Caucasian children has increased 50 percent, to one in eight. About one in five African American and Hispanic children are overweight or obese, more than double the rate 10 years ago. Health experts are concerned by these trends. Obesity that begins in childhood often remains in adulthood and could set the stage for many health issues including heart disease and type 2 diabetes. In fact, among adults, more than 300,000 deaths annually are linked with obesity.*

With regard to physical activity, nearly 50 percent of American youth are not vigorously active on a regular basis and one-fourth of American young people ages 12-21 report no vigorous physical activity. Participation in all types of physical activity declines as age and grade in school increases. Among North Dakota students in grades 9 to 12, 67 percent do not participate in even one physical education class during the school week, and about 39 percent fall short of the Surgeon General's recommendations for moderate physical activity on five or more days of the week. About 39 percent report spending time engaged in vigorous physical activity on fewer than three days per week. In addition, about 48 percent of North Dakota high school students report they are trying to lose weight, and 83 percent do not eat the recommended five servings of fruits and vegetables daily. Habits begun in childhood often persist in adulthood. About a fourth of the adult U.S. population fails to engage in physical activity during their leisure time while only 15 percent regularly engage in vigorous physical activity during leisure.

North Dakota has some unique health- and nutrition-related concerns, including an increased risk of diabetes. NDSU has developed a range of programs that target those problems. In addition, the variety of crops grown in North Dakota presents opportunities for producers and processors to look for innovative ways to improve the healthy qualities of the food supply.

The NDSU Extension Service has helped form 5 Plus 5 coalitions across the state. These coalitions bring together local experts to work toward the goals of the 5 Plus 5 program: to increase the consumption of fruits and vegetables to at least five servings daily and increase physical activity levels to at least 30 minutes of moderate activity on five or more days of the week. In 2001-2002, 15 coalitions developed community-wide educational plans and were designated as "5 Plus 5 Communities." To achieve this recognition, they established a partnership including a 5 A Day nutritionist, physical activity expert and influential leader. Other less formalized 5 Plus 5 programs have occurred throughout the state.

NDSU researchers have found that feeding sunflower seed as 15 percent of dairy cow diets increased the CLA content in milk fat by about 20 percent. Including sunflower in dairy diets could use production from about 2.1 million acres annually. Similarly, canola contains high amounts of protein and energy from unsaturated fatty acids, making it a useful feed for lactating dairy cows. Cows fed 12 percent canola showed a 17 percent increase of CLA in milk.

In an information campaign directed toward women on three college campuses, awareness of

folic acid increased from 90.4 percent at the start of the year to 98 percent at the end of the educational intervention. Knowledge that folic acid can prevent birth defects increased from 55.6 percent to 90.7 percent. Knowledge of the actual recommendation (400 micrograms) increased from 6.9 percent to 39.3 percent. A statewide task force has been formed and the campaign now is being used statewide.

Key Theme - Human Health: The 5 Plus 5 Program

Cardiovascular disease is the leading cause of death in North Dakota. Nationally, 40 percent of the deaths in the United States are due to heart disease and stroke, with a national annual health care cost of $260 million. Proper nutrition and regular physical activity are two ways to reduce the risk of cardiovascular disease and other illnesses. A North Dakota Department of Health survey found that only 18 percent of North Dakota adults eat five servings of fruits and vegetables per day, and 34 percent of North Dakotans are completely physically inactive outside of work. Participants in 5 Plus 5 programs range in age from children to adults.

Impact: Fifteen community-based groups have received "5 Plus 5" recognition for their community coalitions. According to the survey results of one four-county 5 Plus 5 Coalition, 20 percent of the participants increased the number of days they engage in physical activity per week. Fifteen percent increased the number of servings of fruits and vegetables they eat every day. Twenty percent improved their knowledge of what constitutes a serving of fruits or vegetables or the recommendations for physical activity.

Two-hundred-forty-four youth participated in a program titled "On The Move." Knowledge of recommended daily amounts of fruits and vegetables ("5 A Day") increased from 52 percent (pre-survey) to 94 percent (post-survey). Self-reported consumption of five servings of fruits and vegetables increased from 27 percent (pre-survey) to 45 percent (post-survey). Self-reported daily physical activity increased from 75 percent (pre-survey) to 90 percent (post-survey).

Scope of impact: Statewide extension

Source of federal funds: Smith-Lever

Key Theme - Human Health: Folic Acid Consumption

Research shows that folic acid intake prior to pregnancy and throughout the first trimester can prevent 50-70 percent of neural tube defects. Since half of all pregnancies are unplanned, the Centers for Disease Control and Prevention (CDC) recommends all women of childbearing age consume 400mcg of folic acid each day. Two-thirds of women in the U.S. report consuming insufficient levels of folic acid. Preventing birth defects would ultimately have a significant impact on the reduction of health care costs. According to the CDC, the average lifetime health care cost to society for a child born with spina bifida is over $530,000. In addition to prevention of birth defects, a growing body of scientific research links adequate folic acid with reducing risk for heart disease, certain types of cancer and possibly, Alzheimer's disease.

This project, with some funding from March of Dimes, targeted more than 10,000 18-24-year-old
women on three college campuses with folic acid education based on the CDC's "Ready or Not" national campaign. Collaborators included an extension specialist; public health nutritionist; college wellness coordinators, nurses and pharmacists; and dietetics students from two campuses.
The multi-faceted, nine-month, campus-based campaign used radio, newspaper ads, bathroom stall ads, direct mail promotions and peer educators to reach women with information to help prevent future birth defects. Campus promotions were held in cafeterias, libraries, health centers, dorms and sororities. Pre/post tests of over 1,200 females enrolled in general education courses were administered during the nine months of the project.

Impact: Awareness of folic acid increased from 90.4 percent at the start of the year to 98 percent at the end of the educational intervention. Knowledge that folic acid can prevent birth defects increased from 55.6 percent to 90.7 percent. Knowledge of the actual recommendation (400 micrograms) increased from 6.9 percent to 39.3 percent. The media campaign was assessed by media reports of reach. For example, about 61 percent of the target population was reached 8.3 times by the radio campaign. Per month, 137,700 females 18-24 years of age were exposed to the messages contained in the bathroom stall ads. All on-campus students received the direct mailing of coupons. In addition to media reports, 71.7 percent of female respondents reported seeing displays on campus, 61.2 percent had read a folic acid poster, 63.4 percent had seen folic acid information in bathroom stalls, 32 percent had heard folic acid messages on the radio and 22.9 percent had read a folic acid table tent in a dining center. About 48 percent of the survey respondents reported taking multivitamin supplements. A folic acid statewide task force has been formed, and the campaign is being used statewide.

Source of federal funds: Smith-Lever

Scope of impact: Regional extension

Key Theme - Human Health: Calcium Consumption

A curriculum consisting of six lessons was developed and piloted with children, mainly from limited income families, in three fourth-grade classrooms in an ethnically diverse school. The lessons included hands-on activities, taste tests, art activities, etc. and the children were asked to monitor and record their daily intake of calcium-rich foods. Classroom posters that changed weekly were displayed in the classroom. Evaluation consisted of pre/post surveys with knowledge, attitude and behavior questions.

Impact: Fifty-nine children (54 percent male, 81.3 percent Caucasian, 8.5 percent African American, 6.8 percent Hispanic, 3.4 percent Asian) ranging in age from 8 to 11 participated in the project. Eighty-five percent of the children reported preparing meals or snacks for themselves one or more times weekly, which reinforces the need for nutrition education at an early age. The participating children increased their knowledge as a result of the project, and responses to attitudinal and behavioral questions also showed improvement. On the post-survey,

94 percent of the children strongly agreed with the statement, "eating healthy is good for my health," compared with 79.6 percent on the pre-survey. On the post-survey, about 17.5 percent of the children reported they drink soda pop every day, and about 71 percent said they would choose milk over soda pop when given the choice. About 81 percent said they would drink less soda. About 90 percent of the children said they would tell their families what they learned. Results of the pilot program will be used statewide.

Source of federal funds: Smith-Lever

Scope of impact: Regional extension

Key Theme - Human Nutrition: Expanded Food and Nutrition Education Program

The Expanded Food and Nutrition Education Program (EFNEP) teaches limited-resource audiences how to improve their dietary practices and become more effective managers of available food budget resources. The nutrition education assistant (NEA) helps families to increase knowledge of the essentials of human nutrition, helps in their ability to select and buy foods that satisfies nutritional needs, and improve practices in food production, preparation and food safety.

Impact: A variety of delivery methods are used to improve nutrition practices in each of the six counties where we reach adults and youth through EFNEP education. Evaluations show:

- 87 percent of homemakers showed improvement in one or more nutrition practices such as plans meals, makes healthy food choices, prepares foods without adding salt, reads nutrition labels or has children eat breakfast.

Source of federal funds: Smith-Lever

Scope of impact: Six counties, four of the sites are located at tribal reservations.

Key Theme - Human Nutrition: Food Safety

The EFNEP Program focuses on increasing the ability of families receiving food stamps to make wise use of their food dollars. This is accomplished by providing classes to low-income resource audiences on nutrition and meal planning; food purchasing, preparation, and safety; and food resource management.

Impact: Staff received training on the food safety. Participants in the food safety classes received food thermometers to ensure proper cooking temperature of their food. Follow-up evaluations show:

- 57 percent of homemakers showed improvement in one or more of the food safety practices such as thawing and storing foods properly.

- 60 percent of participants at entry into the EFNEP program demonstrated acceptable food safety practices. At the end of the program, 89 percent of the participates demonstrated acceptable food safety practices.

Source of federal funds: Smith-Lever

Scope of impact: Six counties, four of the sites are located at tribal reservations

Key Theme - Human Nutrition: Food Resource Management

One of the overall goals in the area of food resource management for the past year was to help clients manage their food budget. Staff used the new curriculum developed by the University of Wisconsin entitled ***Money for Food***.

Classes are often held at a variety of cooperating agencies such as tribal organizations, WIC or Head Start.

Impact: North Dakota residents attended food resource management programming. Participants defined a variety of means to help them effectively manage their limited resources. Surveys show:

- 76 percent of homemakers showed improvement in one or more food resource management practices, such as plans meals, compares prices, does not run out of food or uses a grocery list.

- 21 percent of the participants at entry level demonstrated acceptable practices of food resource management, compared to 46 percent at the end of their series of classes.

Source of federal funds: Smith Lever

Scope of impact: Six counties, four of the sites are located at tribal reservations

Key Theme - Nutriceuticals: Boosting CLA

NDSU scientists are adding oilseeds to the diets of dairy cows to see if they increase the levels of conjugated linoleic acid (CLA) in milk. CLA has been identified as an anti-cancer agent and dairy products are the primary source of CLA in the diet.

Impact: Feeding sunflower seed as 15 percent of dairy cow diets increased the CLA content in milk fat by about 20 percent. Including sunflower in dairy diets could use production from about 2.1 million acres annually. Similarly, canola contains high amounts of protein and energy from unsaturated fatty acids, making it a useful feed for lactating dairy cows. Cows fed 12 percent canola showed a 17 percent increase of CLA in milk.

Source of federal funds: Hatch

Scope of impact: Multi-state research

Key Theme - Human Nutrition: Selected Mineral Concentrations in Dry Bean Seed

NDSU researchers are developing practical methods that will enable crop breeders to select for zinc-efficient navy bean and to identify differences in the concentration of zinc, calcium, magnesium and iron in seed of diverse bean genotypes.

Impact: Researchers hope to develop a bean seed high in calcium magnesium, iron and zinc for the health food market. Development of such a variety would improve the nutrition of consumers by putting these nutritionally important minerals into a fiber-rich readily available food.

Source of federal funds: Hatch

Scope of impact: Statewide research

Allocated Resources ($ x $1,000)		**FY02**
1862 Extension ($)	Smith-Lever	896
	State	1,280
	FTE	32
1862 Research ($)	Hatch	27
	State	40
	FTE	0.8

Goal 4: Greater Harmony Between Agriculture and the Environment

***Overview**: Agricultural pollution primarily from non-irrigated crop land, grazing land and feedlots presents a significant threat to North Dakota's surface waters. About 60 percent of the state's total river and stream miles and about 70 percent of the lakes and reservoirs are either threatened or impaired for designated uses. In both cases, the major pollutants are nutrients and sediments from agricultural nonpoint sources. Agriculture also threatens ground water. Over-application of fertilizer can result in degradation of ground and surface water. Livestock waste has been identified as an increasing source of pollutants. The area occupied by feedlots and other concentrated production units is currently relatively small; however, their proximity, relative location in regard to drainage ways and the concentration of nutrients during snow melt or runoff events make them a significant factor for pollution of surface and ground water.*

Less than 1 percent of the original native tallgrass prairie still exists and much of what remains is highly fragmented. Insects are an important part of this complex ecosystem. NDSU researchers are evaluating the effects of burning, haying and grazing (common management techniques) on insects. Results will provide data that will aid managers in making decisions on how best to manage these lands.

NDSU specialists developed techniques for soil testing and site-specific farming based on soil nutrient zones. In studies using zone management of nitrogen in sugarbeets, economic advantages when there is sufficient variability of N range from $10-$100 per acre. A recent American Crystal survey based on harvest receipts and grower practices showed a $45 per acre advantage over conventional soil testing based on zone management and zone management with a $20 per acre advantage over grid sampling. On wheat and sunflowers, net returns are in the range of $5-$15 per acre, which would roughly double profit margins in these crops. In addition, the use of some form of zone N sampling reduces the need for "insurance" rates of N, which are often 40-50 lb. N/acre ($6- $15 per acre current price). There is the intangible benefit of reduction in nitrate leaching due to better N utilization by crops and reduction in over-fertilization.

From 2001-2002, the NDSU Soil Testing Laboratory processed 17,852 soil samples for farmers, ag consultants and researchers from North Dakota and Minnesota. Soil tests and fertilizer recommendations by the Soil Testing Laboratory are recognized as the standard for crop nutrient recommendations in western Minnesota, North Dakota, northeastern South Dakota and eastern Montana. Accurate results and recommendations assure producers that crop nutrient needs are being met efficiently while environmental quality is maintained.

The crop water use maps and numerical tables are used extensively for irrigation scheduling. For example, during June, July, August and September of the 2001 growing season, the crop water use Web site handled over 48,000 successful requests for pages. The average daily requests were over 450.

In the first year of an NDSU study, bison gained faster on less feed in pens with fly ash (a by-product of coal combustion) during the spring thaw and rainy summer months. Runoff from

pens with fly ash and holding pond samples did not contain minerals, heavy metals or other compounds that should restrict the commercial use of fly ash in livestock facilities. The research may provide an inexpensive source of material for producers to use in improving their feedlots and the subsequent performance of their livestock. The research may also alleviate a disposal problem for energy plants and other facilities that burn coal.

Researchers found that being located in the 100-year floodplain lowered home values in Fargo, N.D. and Moorhead, Minn., by $8,990. Required flood insurance premiums for these homes accounted for 81 percent of the depreciation. The results of the study are being used by local policymakers to estimate economic gains and losses associated with flood mitigation projects. The study will also provide policymakers with a justification for accurate floodplain re-mapping efforts which may result in the reclassification of the legal floodplain status of individual homes.

Key Theme - Natural Resource Management: Insect Management to Preserve Tallgrass Prairie

Less than 1 percent of the original native tallgrass prairie still exists, and much of the remaining prairies are highly fragmented. Not only is it important to acquire more land to preserve as natural prairies, but it is imperative to manage existing prairies properly. Traditionally, native tallgrass prairies have been managed by periodic burning (every three to five years), and this seemed to be a sound method (from data gathered on vertebrates and the flora). But recent studies have indicated that fire may not be the best type of management for at least some of the invertebrates. Our research is investigating the effects of burning, haying and grazing on a variety of tallgrass prairie invertebrates.

Impact: This project will produce data that will aid natural area stewards in making the best decisions on how to manage their lands. We are also documenting the invertebrate fauna for our research sites, indicating new distribution records, range extensions and the discovery of rare or endangered taxa, all of which will give researchers, conservationists and the general public a greater awareness of the importance of the tallgrass prairie invertebrate fauna.

Source of federal funds: Hatch

Scope of impact: This research will directly benefit tallgrass prairies which occur throughout much of the Upper Great Plains. Our techniques and ideas may also have some indirect applicability to other prairie areas, and perhaps to conservation in general.

Key Theme - Water Quality: Nutrient Management

Extension specialists and experiment station researchers are developing methods to compare various types of zone delineation methods, which will increase the effectiveness of soil testing and nitrogen fertilization efficiency. Techniques being evaluated include a combine protein sensor, aerial photography, satellite imagery, soil EC sensor measurements, Order 1 soil survey, topography and yield monitor data. Each technique is being evaluated and will be combined with

each other to see if the effectiveness of the zones is increased by their synergy. Sugarbeet growers in the Red River Valley manage about 150,000 acres using satellite imagery and aerial photography to map areas of homogeneous N uptake within sugarbeet fields and then give an N credit or adjustment for subsequent crops. Wheat and sunflower growers in central and western North Dakota are using topography, aerial imagery and electrical conductivity detectors to locate homogeneous zones within fields. These zonal boundaries are used as guides for soil sampling. The move to site-specific approaches is progressing west of the Red River Valley with about 80,000 acres involved.

Impact: In 2002, programs focusing on site-specific management totaled about 1,000 attendees at various presentations around North Dakota. In addition, site-specific soil testing has been woven into nearly all presentations given, amounting to about 2,000 other attendees. News releases on radio and in the press have been provided for people who do not attend meetings. Four circulars were printed in 1999 to provide general site-specific information regarding sampling, fertility, concepts and environmental benefits. These have been well-received by growers and received a national award from the American Society of Agronomy in 2000. It is estimated that an additional 20,000 growers were contracted indirectly to some aspect of site-specific farming/N management in 2002. In studies using zone management of N in sugarbeets, economic advantages when there is sufficient variability of N range from $10-$100/acre. A recent American Crystal survey based on harvest receipts and grower practices showed a $45/acre advantage over conventional soil testing based on zone management and zone management with a $20/acre advantage over grid sampling. On wheat and sunflowers, net returns are in the range of $5-$15/acre, which would roughly double profit margins in these crops. In addition, the use of some form of zone N sampling reduces the need for "insurance" rates of N, which are often 40-50 lb. N/acre ($6-$15/acre current price). There is the intangible benefit of reduction in nitrate leaching due to better N utilization by crops and reduction in over-fertilization of "leaky" areas of the field.

Source of federal funds: Smith-Lever and Hatch, USDA-ARS IFAFS

Scope of impact: Multi-state research and extension, MN and MT, MN and SD

Key Theme - Nutrient Management: NDSU Soil Testing Laboratory

From 2001-2002, the NDSU Soil Testing Laboratory processed 17,852 soil samples for farmers, agricultural consultants and researchers from North Dakota and Minnesota. This number represents a 5.97 percent increase over the previous year.

Impact: Soil tests and fertilizer recommendations by the Soil Testing Laboratory are recognized as the standard for crop nutrient recommendations in western Minnesota, North Dakota, northeastern South Dakota and eastern Montana. Accurate results and recommendations assure producers that crop nutrient needs are being met efficiently while environmental quality is maintained.

Source of funding: Hatch

Scope of impact: Multi-state research and Extension, MN, MT and SD

Key Theme - Water Quality: Farm-scale Management Tools to Protect Water Quality

NDSU researchers are attempting to relate nitrogen management systems for common cropping systems to nitrate concentrations in ground water using remote-sensed data such as aerial photography and satellite imagery. Information from the research will help soil scientists develop field-scale nitrogen transport models that will predict movement of nitrogen under various crop management strategies.

Impact: The project may improve groundwater quality by reducing nutrient over-application. Reduced application of crop nutrients also increases the economic benefits by decreasing money spent on nutrient application. Growers of lower-value commodities and high-value crops may benefit from adopting the precision-nutrient management techniques developed from this study.

Source of federal funds: Hatch

Scope of impact: Statewide research

Key Theme - Water Quality: Irrigation Technical Information and Assistance

Effective irrigation water management requires accurate daily crop water use estimates. Since 1995, extension has had a Web site that displays the crop water use for the 10 major irrigated crops in North Dakota. The water use for each crop is calculated using data from the 60 automated weather stations on the North Dakota Agricultural Weather Network (NDAWN). During the growing season, the crop water use data is updated daily. The user can view the daily water use of each crop as color-coded maps or as numerical tables. To use the maps for irrigation management purposes, the irrigator or crop consultant selects both the crop and the nearest emergence date. Every year since 1995, additional features have been added to help the irrigator or crop consultant make better, more informed irrigation decisions. For instance, a color-coded map showing the cumulative rainfall measured at each NDAWN station was added in 2001. Because of the drought conditions in the southern part of the state during the 2002 season, a color-coded map showing the difference between the crop water use and rainfall was added. This map clearly showed the areas of the state with deficit water conditions as the growing season progressed.

Impact: The crop water use maps and numerical tables are used extensively for irrigation scheduling. For example, during June, July, August and September of the 2001 growing season, the crop water use Web site handled over 48,000 successful requests for pages. The average daily requests were over 450. The busiest day of the week was Monday with over 18,000 requests during the growing season. The Web site was accessed the most in August (over 16,000 requests), which is not surprising since it was the hottest and driest month. Over 800 distinct computers accessed the Web site. The crop water use numerical tables were requested about 10

times more often than the crop water use maps. There are about 1,500 irrigators in North Dakota. Many contract with crop consultants for information services. Most consultants that work with irrigators access the Web site at least twice per week and increase the impact of the irrigation water management information by providing a multiplier effect.

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension

Key Theme - Natural Resources Management: Irrigation Research for High-Value Crop Production and Water Resource Protection

As North Dakota producers move to diversify their cropping strategies and boost farm income, improved management practices need to be developed for irrigated production of high value crops. NDSU researchers are developing improved irrigation water and cultural management information and tools for the production of high-value crops in North Dakota.

Impact: Results from the research will promote profitable and efficient production of wheat and potatoes while minimizing adverse environmental impacts. Specifically, developing recommendations for irrigation, nitrogen fertility, variety selection and planting configurations can help producers maximize profitability by using appropriate water and nitrogen inputs.

Source of federal funds: Hatch

Scope of impact: Statewide research

Key Theme - Water Quality: Livestock Waste Technical Information and Assistance

Two Environmental Assurance Program Workshops were held for pork producers dealing with regulations, odor control, nutrient management, community relations and composting.

An extension specialist acted as coordinator for the On Farm Odor/Environmental Assurance Program (a National Pork Producer's Council initiative) and recruited 22 assessors (Extension, NRCS and consultants) and organized their certification school. The program is designed to offer pork producers a free, confidential review of their operation's environmental strengths and weaknesses.

An interagency Livestock Waste Management and Utilization Workshop was designed to provide technical and field staff with a basic grounding in the issues that comprise the Comprehensive Nutrient Management Plans proposed by EPA/USDA. The two-day workshop was attended by 90 participants representing NRCS, SCDs, NDSU Extension Service, NDDH, Section 319 funded water quality coordinators, producer group boards, North Dakota Dept. of Agriculture, North Dakota Water Commission, North Dakota Game and Fish and tribal agencies.

Manure Application Planning Workshops were held at 10 locations around the state. The objective of the workshop was to give producers the planning and record keeping skills necessary to make better use of their manure as well as meet NDDH requirements. More than 120 producers, along with 45 local extension and NRCS/SCD staff, attended the four-hour workshops. Each participant received a binder containing all of the information required to prepare a manure application plan. In their evaluation questionnaires, 15 out of the 120 producers reported that they had used manure tests in the past. Thirty-nine producers had tested soil from fields receiving manure, 17 had used manure nutrient credits to reduce fertilizer purchases, seven had kept written records of manure applications and 10 had performed a calibration of the manure spreader.

Impact: EAP Workshops-- Of the 12 producers who completed an evaluation form, 11 were planning to make changes in the way they manage their manure.

OFO/EAP Program– Eight assessments were completed as part of the training program. One producer has participated since the program began.

Livestock Waste Management and Utilization Workshop-- On a scale of 1 (not useful) to 5 (very useful), evaluations from the participants scored the workshop at 4.1. The most common suggestions for follow-up activities or topics included a field day to view successful waste management systems, more information on regulations and permits, information on system costs and more information on manure utilization.

Manure Application Planning Workshops-- Seventy-six percent of the producers who participated said they were going to implement changes in their manure management practices. The most common intended changes were to test manure nutrient concentrations, to give credits for the manure nutrients applied and to keep records.

Source of federal funds: Smith-Lever and EPA

Scope of impact: State specific

Key Theme - Recycling: Fly Ash for Feedlots

The University of North Dakota Energy and Environmental Research Center and NDSU researchers are evaluating the placement, engineering performance and environmental performance of fly ash, a by-product of coal combustion. Fly ash was combined with a clay base and compacted for a feedlot surface.

Impact: During the first year, bison gained faster on less feed in pens with fly ash during the spring thaw and rainy summer months. Runoff from pens with fly ash and holding pond samples did not contain minerals, heavy metals or other compounds that should restrict the commercial use of fly ash in livestock facilities. The research may provide an inexpensive source of material for producers to use in improving their feedlots and the subsequent performance of their livestock. The research may also alleviate a disposal problem for energy plants and other

facilities that burn coal.

Source of federal funding: Smith-Lever and Hatch

Scope of impact: State specific.

Key Theme - Land Use: Benefits and Costs of Resource Policies Affecting Private and Public Land

NDSU researchers are evaluating the cost of wetland restoration programs in the Red River Valley to weigh against benefits including reduced flood damage and improved wildlife habitat, recreation and water quality. The research focuses on upland water storage to reduce downstream flooding.

Impact: Researchers found that being located in the 100-year floodplain lowered home values in Fargo, N.D., and Moorhead, Minn., by $8,990. Required flood insurance premiums for these homes accounted for 81 percent of the depreciation. The results of the study are being used by local policymakers to estimate economic gains and losses associated with flood mitigation projects. The study will also provide policymakers with a justification for accurate floodplain re-mapping efforts which may result in the reclassification of the legal floodplain status of individual homes.

Source of federal funds: Hatch

Scope of impact: Multi-state research, MN.

Key Theme - Integrated Pest Management Pest and Disease Information for Producers

A regional survey for estimating wheat midge overwintering populations was completed for the seventh consecutive year. The project is funded by the North Dakota Wheat Commission. The outcome of these annual surveys has been the creation of an infestation risk map for use by wheat growers and industry. The small grains IPM survey included scouting for the presence of grasshopper nymphs, cereal aphids and cereal leaf beetle. The field survey information was made available through the weekly NDSU Extension Crop and Pest Report. This survey program evolved during the past two seasons to include interfacing of georeferenced data collection with mapping software now available. The maps summarizing the sampling data were used to graphically illustrate where pest problems were developing in the region. Pest problems included the insects already mentioned and numerous cereal diseases.

Impact: Knowing the wheat midge infestation risk prior to spring planting improves crop and budget planning. Similarly, up-to-date information on other pests and diseases allows producers to manage those pest and disease problems effectively.

Source of federal funds: Smith-Lever

Scope of impact: State Specific

Key Theme - Conservation of Biodiversity: Evaluation of Transgenic Corn

Commercial seed companies have developed transgenic corn varieties that produce insect-toxic proteins for the protection of plants from feeding injury. One particular event expresses a beetle-specific protein that is toxic to corn rootworms. An investigation is being carried out to determine whether this material is likely to pose any measurable threat to abundance or species diversity of non-target Coccinellidae (Lady beetles) that are common to Midwestern corn field habitats.

Impact: The potential effects of this material on non-target insect taxa with similar evolutionary histories to corn rootworms are not well understood. This information will be helpful in understanding the overall environmental impact of this promising pest management strategy.

Source of federal funds: Hatch

Scope of impact: Multi-state integrated research and extension. The insects are widely distributed from the central plains between Texas and North Dakota to the northeastern seaboard. Currently, more pounds of insecticide material are applied for control of corn rootworms than for any other insect pest in the United States. Transgenic technology has the potential for allowing major reductions in use of conventional insecticides for this key pest of corn.

Key Theme - Drought Prevention and Mitigation: Drought Response

As the growing season progressed in 2002, drought conditions worsened across southern North Dakota. Crops losses in some areas were near 100 percent and rangeland and pastures for livestock were rapidly depleted.

NDSU specialists held drought seminars across the reach to address nutritional needs of livestock, use of alternative feeds, water quality concerns, nitrate poisoning and financial management. Economists developed spreadsheets to help producers evaluate management options. Staff also worked with nurses, counselors, clergy and other professionals who interact with producers and their families to provide information on detecting depression and explain the availability of low-cost health insurance and other resources. FeedList, an NDSU web site that brings together buyers and sellers of feedstuffs, was expanded to help producers find feed for their livestock. The site had nearly 14,000 hits between May and October. Range specialists studied the quality and nutrient content of hay from CRP and other alternative sources to provide guidelines for producers. Research on alternative feeds, annual forages and the use of co-product feeds helped producers find low-cost alternatives to traditional feeds.

Impact: Livestock and crop producers in drought-stricken areas were better able to plan for the livestock feeding season and for the coming crop year with assistance and analysis from NDSU specialists. Producers were able to largely avoid drought related hazards to their livestock such

as nitrate poisoning and poor water quality. In addition they were able to minimize costs by using NDSU analysis and recommendations on using alternative feeds such as agricultural processing co-products and CRP hay.

Source of federal funds: Smith-Lever

Scope of impact: Multi-state, SD

Allocated Resources ($ x $1,000)		**FY02**
1862 Extension ($)	Smith-Lever	224
	State	320
	FTE	8
1862 Research ($)	Hatch	136
	State	200
	FTE	4

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

Overview: The Great Plains is a vulnerable region in the United States because of its historical dependence on agriculture and its relatively sparse population base. In the 21st century, shaping forces will include information technology, agricultural technology, changes in federal policies and international trade policy. Major changes in the rural landscape are causing great stress as well as creating new opportunities. A growing body of research suggests that the major contributing factor to the continuing decline among rural counties is their inability to adapt to the changes taking place.

Economic development has been a concern for North Dakota policymakers since the economic downturn of the early 1980s. Retail sales, adjusted for inflation, fell almost 20 percent from 1980 to 1988 and still have not regained their 1980 level. From 1980 to1992, all but five North Dakota counties experienced decreases in employment. Local leaders also understand that they must adapt to the many changes taking place and involve citizens as equal partners in decision-making and action. They must focus more effort on broadening the base of participation to reflect the cultural and ethnic diversity of their communities. They must embrace multi-jurisdictional, as well as public/private partnerships, to gain efficiencies of size. These leaders want and need technical assistance and training to strengthen their own skills and knowledge so they can be effective in this changing environment.

At the same time, the state's youth need opportunities to be meaningfully involved in family, school and community in order to develop skills and confidence to become productive, caring adults who contribute positively to society. Experiential learning in areas relating to healthy lifestyles, preparing for careers, developing communication, social skills, leadership and community involvement can provide the education and development of these life skills.

Data continues to be gathered on the character education efforts in North Dakota with more than 50 percent of counties committing staffing resources to this emphasis area. The concept of moving from school-based character education to building "communities of character" is developing within the state program. Additionally, "ethics in sports" and "code of ethics for the professional youth worker" have surfaced as opportunities to teach character education to targeted adult audiences who have a direct impact on teen audiences in the state.

Approximately 384 people participated in 10 agritainment workshops. Of those participating, 186 completed the post-workshop evaluations. Results include: 99 percent gave the program an overall rating of useful to very useful; 107 people indicated that the workshop did help them to make a decision as to whether or not they would pursue starting a recreation business; 32 percent were already in business; 86 participants plan to start a business; of those already established, 30 indicated they would make changes in their current operation based on what was learned.

Technology leadership continues to be a priority youth development emphasis. County level technology teams have been established to help North Dakota youth develop the necessary skills to engage them in community activities and to prepare our state's youth for the future. In

addition to an active state level youth technology team , eight counties have organized local technology teams.

Faced with drought and economic concerns, rural families face escalating stress. Clergy, therapists, county agents and other professionals often do not have the training to help families deal with that stress. The NDSU Extension Service held workshops to provide background and show them what resources are available. Of those reporting, 86 percent stated the training on understanding rural families under stress and the related impacts to be significantly or very useful in their work. And, 85.8 percent of the participants also indicated that the resources and training materials provided were significantly or very useful to them.

Agricultural producers were also faced with the complex decision of updating base acres and yields for enrollment in the Farm Bill. NDSU specialists developed a spreadsheet to help producers evaluate the choices. In McKenzie County, the NDSU Extension Service conducted an analysis on about 240 farm units representing about 75 producers. The expected commodity payments increase about $750 per farm unit when compared to retaining existing acreage base and yields. In addition, the total impact for these first 240 analyses from choosing the most advantageous option is about $180,000 total. If this trend continues for the remaining farm units, the total impact to producers in McKenzie County could reach about $750,000 from being able to choose the best option financially. If the increase in direct payment rates, the conservation provisions and other provisions of the new Farm Bill are added, the total impact to McKenzie County producers could be well over $1 million.

Key Theme - Community Development: Rural economic development

The extension specialist co-developed a comprehensive business retention and expansion visitation program to help interested community leaders identify existing business issues and needs. Research specialists in the NDSU Department of Agribusiness and Applied Economics analyze and present the data to community leaders. The NDSU Institute for Business and Industry Development follows up with individual requests from manufacturers. Annual progress surveys are conducted. An additional county-based program began in July 2000 and concluded in 2001. The State Department of Economic Development and Finance, now the North Dakota Department of Commerce, funded the primary research portion of the project.

Partners: Local economic development and chamber of commerce staff, State Department of Economic Development and Finance, NDSU - IBID and local county or city economic development groups and chambers of commerce.

Impact: Fourteen county- and city-based programs have been conducted since 1995. Eleven of the first 13 program coordinators responded to a follow-up survey conducted in this program year. Results include: of the 176 projects planned, 43 percent or 75 projects were in progress, 23 percent or 41 projects had been completed, 11 percent or 20 projects were dropped, and 23 percent or 40 projects had no indication as to progress. The last county conducting the BR&E visitation program completed its program in January 2001. A survey conducted after three months indicated that of the 15 action items identified in four major issue areas, only six items

had no action while three had already had substantial progress or were already implemented. The other items were in the process of being worked on. A six-month evaluation of progress for implementation resulted in an overall lower degree of implementation. This would seem to go against logic but upon further questioning of participants it was felt that some of the momentum had been lost resulting in lower scores. Evaluations will be again conducted in 2002.

Source of federal funds: Smith-Lever

Scope of impact: Integrated research and extension

Key Theme - Impact of Change on Rural Communities: Strategic planning

The extension specialist chaired a committee consisting of multiple agencies and organizations to develop and deliver a statewide curriculum and program for community strategic planning. Extension specialists also provided facilitation training for staff from the following agencies and organizations: USDA Rural Development, USDA Rural Development Council, State Department of Economic Development and Finance, State Department of Community Services, Governor's Office Regional Planning Councils, North Dakota State Department of Health and local economic development professionals.

Impact: One-hundred-and-two facilitators for the strategic planning process were trained in two, two-day workshops. Seventy-two of the facilitators attended another one-day session for pilot program updating and specific facilitator skills training. Seventy-six communities are currently in the process of conducting strategic planning programs with the assistance of the trained facilitators. An additional 15 communities were identified and participated as three member teams in a Heartland Center training sponsored by Federal Land Bank.

Source of federal funds: Smith-Lever

Scope of impact: State specific

Key Theme - Supplemental Income Strategies: Rural economic development

Extension specialists and county extension agents conducted educational agritainment workshops in 10 areas of the state. The goal of the program was to provide information to help families decide if a recreation business was feasible for their individual location and operation.

Partners: Local economic development staff, Southwest Area REAP board and North Dakota Department of Tourism.

Impact: Approximately 384 people participated in 10 agritainment workshops. Of those participating, 186 completed the post-workshop evaluations. Results include: 99 percent gave the program an overall rating of useful to very useful; 107 people indicated that the workshop did help them to make a decision as to whether or not they would pursue starting a recreation business; 32 percent were already in business; 86 participants plan to start a business; of those

already established, 30 indicated they would make changes in their current because of what was learned.

Source of federal funds: Smith-Lever

Scope of impact: Multi-state extension and MT

Key Theme - Impact of Change on Rural Communities: The socioeconomic impacts of new agricultural processing facilities

Expanded processing of agricultural products in rural areas has been widely pursued as a strategy for community economic development. Expansion of value-added agricultural processing in rural areas is generally seen as a positive development; however, this expansion has not been without its problems for some communities. The objective of this completed study was to gain a better understanding of the socioeconomic impact of new agricultural processing plants. The impacts of these plants on rural communities were evaluated through data collected from community leaders, company officials and area residents in four North Dakota towns that are the sites of new agricultural processing facilities developed during the 1990s. Study results indicated that improved job opportunities and enhanced incomes were generally seen as major positive effects of each of the new processing plants. Residents' incomes were enhanced both by the plants' jobs and payroll (which often represented second incomes for area households) and by increased incomes for area farmers (either from dividends paid directly by the processing plants, from higher prices for a crop already being produced or by allowing producers to raise a commodity that previously had no viable market). Because most of the plant jobs were taken by persons already living in the area, the new plants did not lead to substantial immigration or major population growth in the host communities, but rather served to stabilize the local economy and population (or to slow the rate of decline). Of all the effects of the plants, only air quality and water quality were more often rated as negative than positive by local residents. However, interviews with community leaders indicated that even these effects did not constitute major problems or issues.

Impact: Study supports activities by local and state economic development staff to encourage creation of value-added agricultural processing facilities in the state.

Source of federal funds: Hatch

Scope of impact: State specific

Key Theme - Impact of Change on Rural Communities: The socioeconomic impacts of plant and mine closures

Adjustments to downsizing or closure of a major community employer were analyzed by describing the approaches employed by some midwestern communities to maintain or restore their economics vitality in the face of a major plant closing or downsizing, and describing the economic, community and social organizational factors related to those community development

efforts. The communities ranged in size from about 400 to 10,000 residents.

Impact: Design for lessening the impacts of plant closures should be based on findings of the report regarding effective policies employed in the study communities. Communities facing a closure/downsizing in this study tended to make a "better" adjustment when there was/were:

- An economic development organization (regional if not local) in place prior to the closure;
- Cohesion of community and agency leaders who were not concerned with "turf" issues;
- A focus on both assisting displaced workers and promoting economic development;
- Substantial lead time prior to closure/downsizing;
- An understanding that the adjustment period from downturn to upturn was not overnight, but might take months, or even years, but a "can do" attitude prevailed throughout;
- A closure/downsizing that was not the sole or dominant employer;
- Some displaced workers who were not local residents, but were commuters; and
- A range of alternative re-use options for the closed facility, rather than a single restrictive use-option.

Source of federal funds: Hatch

Scope of impact: National

Key Theme - Impact of Change on Rural Communities: The economic effects of migration

This study describes basic socioeconomic characteristics of new residents to North Dakota, the factors motivating their move and their satisfaction with the North Dakota communities where they live. New residents who responded to the survey were generally younger than the North Dakota population overall; about two-thirds were between 21 and 40 years old. The educational level of the migrants was also higher than that of the state's population overall; 47 percent of the new residents were college graduates and an additional 35 percent reported some college or post-secondary vocational/trade school attendance. About 48 percent of the new residents had previous ties to North Dakota.

The new residents most often mentioned the following reasons for moving to North Dakota: looking for a safer place to live (59.5 percent), closer to relatives (50 percent), quality of the natural environment (49.5 percent), lower cost of living (48 percent), outdoor recreational opportunities (38 percent) and quality of local grade/high schools (35 percent). New job opportunities or transfers were central to many new residents' decisions to relocate. About 65 percent of the new resident households indicated that a new job or business opportunity, a transfer by a current employer or a military transfer had been a key factor influencing their decision to move. Following their move to North Dakota, about 67 percent of respondents and 69 percent of their spouses or partners were employed full time, while 12 percent of respondents and 11 percent of spouses were employed part time.

Impact: Understanding of factors underlying in-migration decisions will be useful to regional economic development staff in providing services and concentrating on factors favorable to

increasing population growth in areas of North Dakota experiencing growth.

Source of federal funds: Hatch

Scope of impact: Multi-state research

Key Theme - Consumer Management: Improving Decision-Making Among Consumers

North Dakota consumers are faced with increased decision-making responsibilities regarding new products and services, new ways of purchasing and new ways of receiving product and service information and support. Educational programs and materials on topics such as choosing long-distance phone service, shopping from home and identity theft are only a few of NDSU's recent consumer education resources. Other agencies, such as the Consumer Protection Division of the North Dakota Attorney General's office will be collaborated with to provide a comprehensive source of sound consumer information. The goal of consumer education efforts at NDSU is to help consumers make informed choices in the market place, understand their redress options and improve their overall quality of life. A challenge for NDSU Extension is to help citizens of the state be able to determine the validity and reliability of consumer information in an information-rich society. Staff will develop news releases and use other media opportunities to promote sound consumer decision-making. National Consumer Protection Week (NCP Week) was promoted with news releases at the state level and local activities at the county level. Consumer education materials were developed, revised and produced by specialists and family economics emphasis agents to assist consumers in making wise consumer decisions. While all consumers in the state of North Dakota will benefit from the consumer management program, certain audiences are targeted, such as limited-resource audiences, prone to predatory lending practices. In addition, the elderly population is growing in the state and special efforts were made to provide sound information for their needs, and for the people who work with and care for them.

Impact: Through this program and strengthened relationships between the NDSU Extension Service and other consumer education organizations, North Dakota consumers will understand their rights and responsibilities as consumers. Consumers will improve their decision-making skills and predatory lending such as rent-to-own strategies and payday loans will decrease.

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension

Key Theme - Estate Planning: Financial Security Later in Life

As North Dakota's population ages, individuals and families have increased needs to prepare for financial security in later life. The national REEUSDA initiative, "Financial Security in Later Life," has been developed to address these issues. North Dakota Extension family economics programming for the next several years will complement this initiative. The research-based framework provides a solid conceptual foundation on which to build needed educational

resources. A review of the protective factors identified in the existing literature suggests there are three key "stops" involved in achieving financial security in later life. Consumers who plan, act and evaluate are more likely to achieve a financially secure later life. "A Roadmap to Financial Security in Later Life" curriculum has been developed to introduce consumers to the importance of achieving financial security for themselves and others and what critical stops they must make along that road. In addition, packaged programs will be developed annually to present the information in a logical order using a user-friendly format.

Impact: This program will increase the number of North Dakota residents who:

- engage in activities which increase their financial literacy related to later life issues.
- use recommended practices in managing their use of credit in light of their long-term goals for later life.
- initiate contributions to a retirement savings plan or increase contributions to retirement plans.
- determine retirement income needs and/or future income needs.
- develop a plan to achieve retirement and/or future income goals.
- establish or revise investment goals.
- participate in employer-provided retirement plans.
- increase their contributions to employer-provided retirement plans.
- increase their knowledge of risks, costs and financing options for health, including long-term care.
- develop a plan for managing long-term health care needs.
- develop an integrated plan for accumulating, protecting and distributing/transferring assets.

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension

Key Theme - Family Resource Management: Helping Families become Money Wise

Most Americans are not satisfied with their current economic situation and do not feel in control of their personal finances. Many rely on sales-oriented information to make decisions concerning significant resources or have unwise credit use practices. Others let compulsive behaviors interfere with their financial goals. North Dakota's economy has depended traditionally on agriculture and energy and these two sectors have been depressed in recent years. In addition, agriculture is undergoing considerable change. Farm families, as well as other families within the state, need to adjust and adapt to these rapid changes that are occurring throughout the state, nation and world. Educational programs are needed to help individuals, farmers, ranchers and families develop competencies to remain financially secure members of North Dakota's economy. Recent studies have documented a lack of financial literacy among youth and adults of all ages in our country: Increased personal debt, bankruptcies, lack of emergency savings and failure to attain financial goals such as an economically secure retirement are a threat to our state's financial well-being. In addition, productivity in the workplace is affected when workers are experiencing financial stress and lack of work/family options. Efforts will focus on several programs including: the High School Financial Planning Program, Becoming Money Wise, New

4-H curriculum- Money Moves and Money Fundamentals, credit education materials and North Dakota Saves.

Impact: Implementing this program will increase the number of North Dakota citizens who:

- engage in activities which increase their financial literacy.
- utilize recommended practices in managing their use of credit.
- establish or revise investment goals.
- increase their knowledge of risks, costs and financing options for health care.
- increase their knowledge of risks, costs and financial options for insuring property and automobiles.

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension

Key Theme - Children, Youth and Families at Risk: Evaluating the Richland County 21st Century Community Learning Centers

The hours after school but before parents return home from work have been recognized as the period of the day during which children are most at risk for delinquency, drug use, crime and pregnancy. For this reason, five rural communities in Richland County are beginning to implement after-school programs which provide supervision and structure for children who would otherwise have been left unsupervised. For 78 percent of the children in these school districts, both parents or one single parent are employed, many more than 25 miles away from their homes. If these programs are of high quality, they will have the potential not only to prevent the problems caused by lack of supervision but also to facilitate positive youth development.

Impact: More than 160 children in grades four through eight are participating in the program, which includes recreation, snack time, homework help, field trips and other structured activities, including regular computer usage. The Department of Child Development and Family Science at NDSU is conducting the ongoing evaluation of the effects of the program. Although lowering the risk of adolescent delinquency is a long-term goal, the current evaluation is focusing on the more immediate goals of improving classroom behavior and student bonding to the program.

So far, participants have marginally improved in classroom behavior, but results differed across schools. Classroom behavior problems decreased significantly in one school, whereas they increased in another school and were relatively stable in the three remaining schools. However, participants in the school experiencing the improvement gave their program significantly lower satisfaction ratings than the other schools. There were also gender differences on both classroom behavior and program satisfaction; girls had higher scores than boys on both scales. Finally, there was a difference in scores by grade. Sixth-graders had the lowest ratings on both classroom behavior and program satisfaction. Seventh- and eighth-graders had the highest satisfaction ratings. Ongoing analyses will be completed to test initial observations that these findings are related to the gender of the staff (nearly all female), the use of seventh- and eighth-graders (but not sixth-graders) as program helpers and the activity mix offered in each program.

Source of federal funds: Smith-Lever, Department of Education

Scope of impact: Extension, Richland County, North Dakota

Key Theme - 4-H Youth Development: Career Readiness/Workforce Preparation

Do youth relate their 4-H activities to career readiness and preparing for the future? This is a question state 4-H specialist staff decided to test with youth participating in the annual state crops judging event. Seventy youth ages 8-17 (averaging 13.2 years) completed the survey and of that group, 84 percent reported gaining skills transferable to school, work or home decision-making dealing with the science of crop production and weed control.

4-H technology teams are both learning critical skills and practicing those skills by teaching others. Robotics, media communication, computer hardware troubleshooting and entrepreneurial ventures are key areas in which North Dakota youth are gaining valuable experience.

Impact: Survey information from participants in the state crops judging show has demonstrated that 4-H events may have an impact on career readiness for youth involved in 4-H. Twenty-three percent of the participants in this survey reported that crops judging participation has had an impact on their future education planning and 29 percent indicated an interest in pursuing a career in crop science. Nearly 70 percent of the participants rated skill building and making decisions as valuable to very valuable life skills benefits through participation in crops judging programs. North Dakota has added county level youth technology teams to its statewide program efforts. Eight teams have been formed, with five more teams organizing by the year's end 2003. The program has grown from eight members serving on a state level technology team to more than 100 members participating on county level teams. The state team has also produced its own promotional video and added robotics as a curriculum area. The state team volunteered more than 124 hours to expanding the technology idea to local counties and in educational classes for 4-H and community youth

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension

Key Theme - Youth Development 4-H: Character/Ethics Education

Today's children have not always had the opportunities needed to make wise choices. 4-H youth programs provide opportunities for youth to develop life skills in communication, working with others and getting along with others. Ethics education is an educational program that has been incorporated into programs within 4-H youth programming as well as in schools and communities throughout North Dakota. CHARACTER COUNTS! is an educational program developed by the Josephson Institute of Ethics and adopted by the NDSU Extension Service to teach six character traits. They are trustworthiness, respect, responsibility, caring, fairness and citizenship.

Impact: More than 25 county extension faculty reported being engaged with character education as a portion of their school enrichment activities. About 25 percent of those reported moving from school-based character education programming to community engagement in building "communities of character" programs. School enrichment education is the main delivery method of the character education program. This delivery method reached more than 18,000 youth during the 2002 program year.

Impact: Six communities have engaged in a community capacity building project that uses a computer-based, "Group Decision Center" Process, to bring youth and adults together to address issues of interest and concern to youth of the community. The GDC process allows all participants to have an equal voice in a public discussion and provides a venue where information is gathered anonymously and simultaneously. More than 500 North Dakota youth and 150 adults have participated in this process and one adult community leader commented, "I feel that the traditional belief that the children and youth were sacred, has been lost." Each of the six communities who have participated received a printed report for followup discussion and use as North Dakota communities work to create environments that help youth grow up safe and healthy.

Source of federal funds: Smith-Lever

Scope of impact: State specific within the National CHARACTER COUNTS! effort

Key Theme - Children, Youth and Families at Risk: Choices in the Heartland: Working with rural families under stress seminars

In the last decade, North Dakota has seen extreme economic and social difficulties for rural families and communities dependent on the agricultural economy. Factors that have contributed to these concerns include depressed market prices, fluctuations in demand for agricultural products, severe weather and increased costs of agricultural production. The 1999 North Dakota Rural Life Poll showed that 98.5 percent of North Dakota farm and ranch operators felt there was a rural crisis and 85 percent of farm and ranch operators were concerned about the negative effects of farm stress on themselves, their spouses or their children. Community professionals who work with families too often have limited familiarity with the particular experiences of rural families under stress or how to effectively provide resources and support.

An intensive one-day training seminar for community professionals was developed on working with rural families under stress. "Hard Choices in the Heartland" focused on the impacts of rural stress on families and communities, effective strategies for working with rural families and developing resources and support for rural families under stress. Intended outcomes for participants included:

- To understand the importance of rural stress on families and communities.
- To become familiar with resources and training materials on working with rural families.
- To become more knowledgeable about effective approaches to working with rural families.
- To plan on accessing or using resources and strategies learned about in their work with rural families.

Five, one-day workshops were offered for community professionals at locations across North Dakota during 2001 and 2002. Training was offered by a collaborative team of professionals from the NDSU Extension Service, Family Therapy Center and North Dakota State University, NDSU faculty and MeritCare Health System.

Impact: A post-workshop survey was administered to evaluate the immediate impact of the training seminar. Participation in the seminar included 146 community professionals, including: extension agents, social workers, psychologists, clergy, nurses, attorneys, addiction counselors, school counselors, farmers, farm loan managers and others. Of those reporting, 86 percent stated the training on understanding rural families under stress and the related impacts to be significantly or very useful in their work. And, 85.8 percent of the participants also indicated that the resources and training materials provided were significantly or very useful to them. Among the seminar participants, 77.1 percent reported that they were much to very much more knowledgeable about effective approaches to working with rural families under stress as a result of participating in the training. Additionally, 74.3 percent of participants said that they were much or very much planning to access or use resources and strategies they had learned about in their own efforts; and another 25.6 percent noted they were somewhat likely to use strategies or resources they had learned in the training. These results suggest a positive outcome for participants regarding their knowledge about rural families under stress and their likelihood of using new resources and strategies in their work with rural families.

Participants were allowed to provide written feedback on the training seminar and offered a variety of comments and feedback, including:

- "I now understand and relate much better to low-income farming families." - Domestic violence outreach worker
- "I appreciated the statistical information, and putting ourselves in others' shoes and looking at the issues facing farm families in a clearer light." - Money management advisor
- "This is one of the most important issues facing North Dakota today. Keep working on this!" - Farm wife and school counselor
- "General information was wonderful and basic concepts for effective approaches was useful - helpful to apply these techniques." - Case worker
- "I was challenged and encouraged to be a pioneer in rural ministry - thank you." - Pastor.

Source of federal funds: Smith-Lever

Scope of impact: State specific extension

Key Theme - Agricultural Financial Management: Farm program analysis

By April of 2003, producers and landowners needed to make important decisions regarding enrollment in the farm program outlined in the Farm Security and Rural Investment Act of 2002. This Farm Bill provides farmers and landowners with a one-time opportunity during this time to update contract base acres and farm program yields used to calculate program benefits. This is possibly the most important management decision that landowners and producers will make this

winter. There are basically seven options from which to choose in terms of updating contract base acres and farm program yields, and there can be significant differences in the projected annual farm program payments between the various options. These differences could have a significant impact on annual profitability of a farm operation and could eventually have an impact on land values. The update decision may be fairly confusing and complex, because in addition to the several options from which to choose, it may also involve several different commodities and uncertain market conditions which will determine the counter-cyclical portion of the farm program payments. To help farmers and ranchers make these decisions, NDSU Extension Ag Economists Andy Swenson and Dwight Aakre developed a spreadsheet to calculate the expected payments under the various options and rank them as well. It also calculates the base acreage, direct payment yields, counter-cyclical yields and the expected payments under the commodity titles for each available Farm Bill option.

Impact: As of Jan. 10, 2003, the Divide County Office of the NDSU Extension Service had run analysis for 32 producers covering 85 farm units, totaling 50,462 acres. The total impact from helping producers and landowners in selecting the best option at this point would be roughly $112,000 per year or $672,000 over the six years of the farm program. If it is assumed that the 15 producers or landowners who have picked up a disk at the office to complete their own analysis have seen similar results, the total impact would increase to roughly $165,000 per year or $990,000 over the six years of the farm program.

In McKenzie County as of Dec. 12, the NDSU Extension Service had conducted an analysis on about 240 farm units representing about 75 producers. The expected commodity payments increase about $750 per farm unit when compared to retaining existing acreage base and yields. In addition, the total impact for these first 240 analyses from choosing the most advantageous option is about $180,000 total. If this trend continues for the remaining farm units, the total impact to producers in McKenzie County could reach about $750,000 from being able to choose the best option financially. If the increase in direct payment rates, the conservation provisions and other provisions of the new Farm Bill are added, the total impact to McKenzie County producers could be well over $1 million.

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension

Allocated Resources ($ x $1,000)		**FY02**
1862 Extension ($)	Smith-Lever	644
	State	920
	FTE	23
1862 Research ($)	Hatch	85
	State	125
	FTE	2.5

B. STAKEHOLDER INPUT PROCESS

Building linkages with the public enable us to discover information about community/county/district/state assets and needs. Various methods for stakeholder input are utilized on an on-going basis. The input from stakeholders plus input from the general public and from targeted audiences is used to develop our long range four year plans of work along with adjustments to the plan based on crisis situations that may develop in the state (drought, flood, insect infestations, plant diseases, high-risk issues of youth, food borne illnesses, security issues). Using several methods to collect data insure that high priority issues are identified, people that have a self-interest in the issue are brought to the planning meetings, and an educational design is developed to address the issue using a variety of delivery methods. Examples of stakeholder input processes are undertaken as follows:

State Board For Agricultural Research and Education (SBARE)

SBARE held monthly meetings during the fiscal year that were also attended by department chairs and research extension center directors. The meetings focused on assessing current programs and identifying issues and needs for new programs. Individual citizens and commodity group representatives provided direct input. The state legislature amended legislation to include two standing legislators as members of SBARE. This arrangement helps assure that legislative support is maintained. Three sub-committees, Crops, Livestock, and Other Programs, were organized as working groups for SBARE. These committees met several times with industry representatives to gathering additional input on issues and needs. SBARE also administers agricultural gas tax funds used to support research programs. Producers and industry representatives serve on commodity committees, which prioritize projects and award funding.

Citizens' Support Group for Nutrition, Youth and Family Science

The Citizens' Support Group for Nutrition, Youth and Family Science meets quarterly . The group meets face-to-face twice a year and by conference call or other technology twice a year.

The membership of this group is based on the following criteria: geographic representation, diversity, content expertise, and leadership roles. Current members, Extension agents, Extension specialists, and others place names in nomination for a three year term on the advisory group.

The role of this citizens' group is to:

- identify emerging areas of research and educational program needs for North Dakota;
- disseminate and promote information focusing on cutting-edge research, recent initiatives, and Extension programs in the areas of nutrition and health, family financial management, family living and parenting, policy education, leadership and community development, and youth development, and;
- serve as advocates for research and educational programs in Nutrition, Youth and Family Science and the impact of these programs at the local and state levels.

Members of the Citizens' Support Group represent the following areas: 4-H youth development,

economic development, elementary and secondary education, faith communities, grant consultants, government officials, health professions, housing authority, value-added agriculture, violence prevention, and the legal professions. The extension director, Dean of the College of Human Development and Education, chair for the Center of 4-H Youth Development, and the assistant director for Nutrition, Youth and Family Science are ex-officio to the advisory group. Extension specialists and agents provide periodic updates to the advisory group using North Dakota data. We have one member of the Citizens' Support Group for Nutrition, Youth and Family Science who also serves on the State Board for Agriculture Research and Education.

Multi-County Program Unit (MPU) Input

In August 2002, the multi-county program unit coordinators met to assess the effectiveness of the multi-county advisory committees for stakeholder input. After a two day assessment of the process using the Group Decision Center computers to respond to a survey, the MPU coordinators and the district directors decided North Dakota State University Extension Service should use several methods for gathering input from North Dakotans. The MPU Advisory Committee is only one method that could be used in a multi-county area to gather input.

MPU coordinators, along with their extension district directors, shared the results of this meeting with agents in each MPU. It was left to the agents in those MPU to decide which methods they would use to gather input. It was determined that even when we base program priorities on input from a representative group of county people we still may fall short of identifying important community/county/district/state issues. In a short survey of agents and district directors, it was identified that other data collection methods could be used including focus groups with targeted audiences and written questionnaires. Extension agents are encouraged to use more than one on these methods for input.

County Government Oversight

County commissioners actively participate in county extension program reviews. The county extension budgeting process also results in strong engagement from county government. This arrangement helps assure that extension programs are grass roots driven and are focused on local issues and needs.

Research Extension Center Advisory Committees

The seven research extension centers (RECs) held winter meetings with their citizens advisory boards that focused on issue identification for both research and extension programming. REC staff not only used this input to set program direction for the center but also conveyed it to main station researchers and to SBARE. Summer meetings and field tours were also held to review programs and observe the progress of research activities.

Irrigation Summit & Caucus

An irrigation summit was held at NDSU during the fall of 2000. The purpose was to promote

effective communication among irrigation interests in the state and NDSU, identify processes for maintaining strong communications, and prioritize research needs. Research scientists presented a synopsis of their current research and their goals for the future. Industry representatives and producers identified additional research issues and needs. This information is used to guide irrigation research and extension program priorities. NDSU research and extension are also assisting the North Dakota Irrigation Caucus develop a long range strategic plan for future irrigation and high value crop development.

Livestock Research and Education Committee

The North Dakota Stockmen's Association Research and Education Committee meets with NDSU faculty and administration on a regular basis to review current research and extension activities and provide input on issues and concerns. NDSU faculty and administration also meet with the Lamb and Wool Growers, Milk Producers, and Pork Producers on a regular basis. This interaction is used to reaffirm that livestock program priorities are addressing the needs of North Dakota livestock producers.

North Dakota Nutrition Council

North Dakota Nutrition Council, established in 1980, has more than 180 members who identify nutrition education needs. The council has representation from several agencies and organizations, each with a specific nutrition focus. North Dakota nutrition issues are identified by the membership and directed to the appropriate agency or organization for action. NDSU Extension Service specialists and agents have taken the lead educational role in addressing several nutrition issues identified by the council.

The Childhood Obesity Prevention

The Childhood Obesity Task Force met for the first time in September 2002. It is comprised of seven Extension Agents, state specialists from 4-H, Child and Adolescent Development, two faculty members from the Department of Health, Nutrition, and Exercise Science and is chaired by the specialist in Nutrition and Health. The task force was developed to determine the NDSU Extension programming effort to reduce the prevalence of childhood obesity within the state of North Dakota. This effort is closely aligned with the efforts by the North Dakota Departments of Health and Public Instruction. These public health/education efforts are being coordinated by Governor Hoeven's "Healthy North Dakota" initiative. The initial summit in August 2002 identified "healthy weight for youth" as one of the important areas for intervention. The mission statement developed by the Task Force is as follows: "To shape the eating and physical activity patterns of North Dakota children and families to promote healthy weight and thus reduce the risk of chronic disease."

Family Life Education Committee

Department of Human Services and NDSU Extension Service Family Life Education Committee was established in 1992 by the North Dakota legislature to educate and support individuals at all points within the family life cycle. The committee meets six times per year to identify issues, plan, and implement educational programs. The NDSU Extension Service is the primary source

of the educational programs and outreach to the state.

C. PROGRAM REVIEW PROCESS

No significant change in program review processes since five-year Plan of Work.

D. EVALUATION OF THE SUCCESS OF MULTI AND JOINT ACTIVITIES

The issues addressed in most "multi and joint" activities were identified by county and multicounty program unit advisory councils along with specific boards and groups like the Sugar Beet Research Education Board and SBARE. The targeted audiences for these programs were inclusive of all clientele with a vested interest in the issue. Many programs are on-going or multiple year in length; however, specific impacts were noted where applicable. Most of these activities resulted in time efficiencies for the extension educator, and they provided a complete educational experience for the end user. The following is a partial listing of multi-state and multi-institution activities undertaken.

Great Plains States Collaboration

Extension program leaders from North Dakota, South Dakota, Nebraska and Kansas continually interact on programming and staff development issues that address needs in all four states. The logic model continues to be utilized as a program planning/ program performance indicator in all four states. North and South Dakota specifically use the logic model to guide their annual program planning process. Both states have also collaborated on the development of "core competency" projects for extension workers.

Cropping systems specialists and agents from the four Great Plains states hosted an in-service workshop designed to foster multi-staff program collaboration and subject matter training for agents. This workshop has fostered the development of on-going communications linkages, the sharing of educational resources and the exchange of programming ideas.

The four Great Plains states are also collaborating on information technology efforts that will mutually benefit all for states. Most of this work is still in the planning stages but will ultimately result in enhanced technology training for extension agents, stronger program delivery focused on rural communities and e-commerce.

Tri-state Corn Work

North Dakota, Minnesota and South Dakota continue to cooperate in planning and delivering extension educational efforts on corn production and utilization. Educational efforts continue to be multi-county/multi-state workshops, field tours and mass media work that emphasizes

production management practices and marketing. Corn production continues to grow in the three states due to market opportunities, excellent yields and adoption of agronomic practices that have made corn a competitive and viable crop in the three-state area.

Northern Plains Sustainable Agriculture Society and Organic Agriculture

The Northern Plains Sustainable Agriculture society (NPSAS) contains members from North Dakota, South Dakota, Montana, Nebraska, Minnesota and Canada. The group's goal is to promote sustainable food production systems in agriculture. While many of the members are organic producers, it welcomes all those interested in producing food in sustainable systems. A North Dakota Extension agent continues to chair this group, with the majority of the members coming from North and South Dakota. NDSU Extension Service staff have been active in developing educational programs for NPSAS. More than five years ago NDSU extension was instrumental in developing the beginning organic farming program for NPSAS. It started out with 10 new producers and now annually draws a crowd of 60 producers from surrounding states. The NDSU Extension Service has also developed an organic crop budget and a bulletin on switching to organic production that is widely used in both North and South Dakota. New organic farmers have used the beginning organic farming tract and the bulletin on switching to organic production to help successful transition into organic production. Organic producers from North and South Dakota have used the crop budgets for financial planning and getting loans for their operation from lenders who are not familiar with organic farming. The North Dakota Extension agent who chairs this group continues to receive an increasing number of contacts from organic farmers, consumers, university personnel and federal agencies looking for advice on organic farming and the organic industry. Current work is focused on facilitating a dialogue on the coexistence of GMO, non-GMO and organic crop production.

EWEASK Regional Sheep CD ROM

EWEASK is a CD on basic sheep nutrition developed by the Northern Mountain Plains Regional Sheep Extension Service Consortium: Sheep Production in the Northern Plains (# 93-ESPN -1-5197). The consortium includes sheep specialists from North Dakota, South Dakota, Montana, and Wyoming. The EWASK CDs have been distributed to county and area offices in all four states (~200 copies). The CD also contains sheep research reports from the four states.

Advanced Crop Advisers Workshop

This is an annual two-day event organized and conducted by the NDSU and Minnesota Extension Service. Participants include crop consultants, agronomists, extension agents, and agri-business representatives primarily from North Dakota and Minnesota, but also South Dakota, Montana, and Manitoba. Instructors include university and agri-business personnel. The objective of the event is to provide new and practical information for crop advisers to update and enhance recommendations provided to farmers. A typical agenda consists of five to six two-hour concurrent sessions. About 130-150 people attend the workshop each year. Scope of impact is multi-state. Written evaluations from the 2000 workshop indicated favorable ratings: presentations = 3.2-4.5, content = 3.0-4.5, and value = 3.2-4.5 (scale: 1 = poor and 5=excellent).

Commercial Vegetable Growers of North Dakota meets Researchers

The CVG of ND recently set up a meeting with new vegetable growers in North Dakota to meet with researchers from around the state and out of state. Researchers from Sidney, Mont., Bagley, Minn. and Staples, Minn., were asked to attend. Having a sounding board to help lead research objectives has worked well in this situation. In previous years, varietal research was targeted by the CVG of North Dakota and another group called the High Value Irrigated Crops Task Force. Research plots were set up in five areas of North Dakota, Montana and Minnesota. The plots were used to select varieties that will do well in the production and marketing project. The CVG of ND has now hired a marketer from within the vegetable industry to bring contracts to new growers and start commercial production. The learning curve is steep with new crops. The meeting with researchers and new growers will lessen that learning curve and give documented data for vegetable production in North Dakota and surrounding states.

Web page assembled to connect producers and Identity Preservation Processors and Markets

The NDSU Extension Service, Northern Crops Institute and the State Seed Department have assembled a web page listing companies that are working with specialty crops and especially identity preserved markets. The web page has been started by contacting processors and markets with a letter asking them to fill out a survey on the internet. If the survey is filled out, the company has a chance to do some advertising or detailing of services at the same time. The final web page is then assembled from the survey and will be a resource for processors and farmers that are looking for situations where they can work interdependently. A separate identity preserved survey has been included on this web site assembly page to research IP and see how the traceable products from IP are being marketed.

Red River Valley Vegetable Task Force

The RRVV Task Force has been in place for several years to draw on expertise from both North Dakota and Minnesota working through the Northern Great Plains Inc. Extension service employees from both states are represented on the Task Force. The group continues to work with French companies that have advanced food processing capabilities. The advanced capabilities are not being used in the United States, which represents an opportunity to do business with farmer-based cooperatives and joint venture with existing U.S. companies. Contacts have been made and feasibility studies have been done to help implement the new process. A pre-processed vegetable project continues to show promise. This pre-processed system used farmers and outsourcing companies to provide bacteria-free farm inputs to the final food processor. This gives the processor the ability to market processed foods without preservatives and still maintain high quality and long shelf life. The first pre-processed product plant has been established in Dawson, N.D. by four farmers who are using field run onions and adding value. The pre-processed onions are doubled in value and are being marketed to final processors and restaurants.

Multi State Onion Research Project

Minnesota, Montana and North Dakota extension and research staff worked together again in 2002 to extend the capacity for vegetable production and marketing in the region. A North Dakota specialist, Minnesota extension agent, a researcher from Sidney, Montana and an extension specialist from extreme western North Dakota worked together to continue coordination of efforts to bring in new knowledge of the vegetable industry. Test plots were planted in 2000 and 2001 at Sidney, Montana; Oakes, North Dakota; Carrington, North Dakota; and Staples, Minnesota. The project has meant sharing of labor, talent and information to move toward a new production area of high-value crop to replace current commodities.

Extension Specialist works with 13 states to start a National Farmers Market Association.

An Extension Specialist from North Dakota worked with Extension Specialists, Direct Marketers and Farmers Market managers to start a national Farmers Market association. The new group was formed at a breakout session (full day) that was held during the recent North American Farmers Direct Marketing Association meeting held in Charlotte, North Carolina. Over $20,000 was raised from 14 states in attendance. Committee meetings will be held during the next year and the first annual meeting of the new association is planned to be held at the next NAFDMA meeting in 2004. The North Dakota Extension specialist contacted the office of the Commissioner of Agriculture and received funding to help the new association as well as support to spearhead a new association within North Dakota.

North Dakota/Montana County Program Collaboration

A small grain variety plot using seed from both Montana State University and North Dakota State University was planted, maintained and harvested as a cooperative venture. A joint small grains tour of this plot and other sites of current interest was planned and conducted. Educational speakers from both states, usually extension specialists, were utilized. The Mon-Dak Wool Pool, a joint 4-H camp, and educational programming in specialty areas are other collaborative efforts where extension agents from both states work together.

4-H Cooperative Curriculum System

A North Dakota 4-H curriculum extension specialist chairs the staff development work team for this system. This involves two monthly phone calls, reviewing proposals and preparing materials, which amounts to about 20 percent of this individual's time. Several North Dakota extension agents are serving on curriculum design teams for leadership and geospatial literacy. Each design team includes members from at least six states. This work involves attending workshops on writing curriculum and leading efforts to write, revise, review, and pilot curriculum pieces.

E. MULTISTATE EXTENSION ACTIVITIES

Value-Added Agriculture Education Program

This effort focuses on three phases of value added agriculture development. The first is to assist producers, industry, etc., identify the strengths and opportunities in the region. The second is to educate clients on constraints and requirements to develop an identified value-added venture. The third is to serve as a resource for implementing identified value added agriculture opportunities.

Impact: Several events aimed at educating the public on the strengths and identified opportunities for the region were held during the year. These events include: MonDak Ag Open, MonDak Value Added Ag Conference, Research Extension Center field days, Wheat Show, MonDak Pulse Day, Sidney Ag Days and Gateway of Opportunities in Glendive, MT. Interest in value-added agriculture was high as between 75 and 300 participants attended each session. The outcome of this effort included identification of four areas that participants felt had the best opportunity for success. The first was potential for high value crop development with the vast irrigation resources in the region (potatoes, onions, and alfalfa were singled out). The second was developing niche crops to be used in rotation with high value crops (malting barley, soybeans and corn were identified). The third was attracting food/ag processing firms for better markets (an alfalfa processing plant will be in production in 2003). The final area of identified opportunity was the development of higher value dryland crops (chickpeas, other legumes, and oilseed crops saw dramatic acreage increases in the past three years).

Throughout the year producers and end users were brought together in an effort to form value added agriculture production and marketing alliances. Four outcomes from this effort are offering value added opportunities to producers in the region.

First, Busch Ag, Cargill and Coors have implemented a malting barley increase program. Acreage of selected varieties of malting barley under contract has gone from a limited number of acres in 1998 to over 50,000 acres in 2002. Busch Ag is constructing an elevator in the region that will be in operation in 2003. Their goal is to market five to seven million bushels of malting barley. The three companies would like to contract well over 100,000 acres of malting barley by the next year.

Second, identity- preserved wheat production for sale directly to end-user markets began in 2000. Ten producers contracting 1,100 acres of identity-preserved hard red spring wheat participated in a pilot program to develop this opportunity. Acreage for this project should increase substantially in following years.

Third, contracted irrigated potato production went from zero acres in 1997 to 80 acres in 1998 up to 1,500 acres in 2001. During the summer of 2000, $2.6 million of potato storage facilities were built as local French fry processors have guaranteed five years of production contracts. Eventually, the region hopes to attract a French fry processing or potato dehydration plant from this effort.

Fourth, pulse and oilseed crops have seen a dramatic increase over the past three years. With over 100,000 acres of legume crops (chickpeas, field peas, lentil, etc.) and over 2 million oilseed acres (canola, mustard, flax, etc.) many new processing facilities have developed. In the region, there was one processor in 1995, now there is 5 processing/marketing facilities.

On the livestock side, one dairy is currently in production with another still looking for buyers and hopefully will be in production in 2003. Alfalfa cubing facility will be in production and will utilize 35,000 tons of alfalfa in the region this first year and projected to utilize 200,000 by 2005. The hay will be marketed in the horse and dairy industries and will be shipped mostly to the Pacific Northwest, California, Texas, Minnesota, and Wisconsin. There will be even marketing opportunities overseas, for example in Japan. Southwest Feeders, a coordinated research-education-networking effort, was initiated in 2003. Successful outcomes of the project will include substantial enhancement of economic activity within southwestern North Dakota associated with the utilization of locally available resources to add value to beef calves and lambs. Since this combination of available agricultural resources is not unique to southwestern North Dakota, the project will continually explore collaborative relationships both within the state and the region. This effort focuses on three phases of value added agriculture development. The first is to assist producers, industry, etc., identify the strengths and opportunities in the region. The second is to educate clients on constraints and requirements to develop an identified value-added venture. The third is to serve as a resource for implementing identified value added agriculture opportunities.

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Agronomy Program

A multi-state project between the NDSU Extension Service, the South Dakota State University Extension Service and Ducks Unlimited continues to promote reduced tillage practices and the production of winter annuals. The project was to determine yield differences among soybeans grown on no-tilled land. Equipment dealers from Sargent and Ransom counties in North Dakota and Marshall and Day counties in South Dakota continue to participate with field demonstrations. Specialists from both NDSU and NDSU gave presentations and led tours of the field demonstrations. Cooperative work between extension and Ducks Unlimited allowed an extensive trial program to be developed. It allowed succinct, current information to be disseminated on no-tillage and production practices. The program allowed farmers from both states to see the trials established, managed though the season and the final results. It also allowed the cooperative project to be produced through both universities and the non-profit Ducks Unlimited organization.

Micro-Rate for Sugarbeet

The use of postemergence herbicides such as Betanex and Betamix is an expensive but necessary practice for the 3,300 sugarbeet growers in the Red River Valley of northwestern Minnesota and eastern North Dakota. Looking to help growers cut costs while continuing to provide weed control in sugarbeet, the Extension Sugarbeet Specialist developed a micro-rate application plan of postemergence herbicides combined with a seed oil additive. One of three herbicides, Betanex, Betamix, or Betamix Progress plus UpBeet plus Stinger are applied in rates that are 66

to 75 percent lower than the standard rates. An oil additive makes the herbicide mixture better adhere to the weeds and aids in penetration. Weeds are treated earlier with the micro-rate and fields are given one more application than the usual three or four applications. The micro-rate can be applied during the day, whereas growers needed to wait until late afternoon to start applying the normal rates, to avoid damage to sugarbeet. In addition, the lower cost of the micro-rate application means that it can be broadcast by aerial spraying. The cost of broadcast application of the full rate, by contrast, would be prohibitively expensive. Researchers are now learning how to apply the micro-rate strategy to weed control in other crops.

Impact: The micro-rate system has been widely accepted by sugar beet growers in North Dakota and Minnesota and shows potential for use in other cropping systems. Average savings per acre of micro-rate application in sugar beet was $20 with a total industry cost savings of $39 million. In addition, the micro-rate can save fields in adverse weather conditions. In the wet spring of 1998, growers were able to use the micro-rate in aerial spraying, whereas they wouldn't have been able to get into the wet fields and aerial spraying at the full rate would have been too expensive. The micro-rate system in corn weed control well reduce herbicide costs in North Dakota by $16 per acre annually. This herbicide application method will both increase net economic income and reduce herbicide use.

Although the active ingredient of the herbicides is not harmful to human health or to the environment when used according to the label, public perception is that using lesser amounts of any herbicide is better for the environment. Therefore, the micro-rate may help to reassure the public by demonstrating that lower amounts of herbicides are being used. Although the micro-rate was developed to help growers save money, another unexpected benefit resulted. Because growers were able to use the micro-rate during the day, instead of waiting until late afternoon or evening, they were free to spend more time with their families, watching their kids play softball or attending other community events. "I was very surprised at the number of growers who told me what a difference this had meant to them and their families," the Extension Sugarbeet Specialist said. Increased time "bought" by the micro-rate may mean building and strengthening family and community ties, which are of vital importance to our sometimes-hectic society.

Source of federal funds: Smith-Lever

Scope of impact: Multi-state research and extension, MN.

Sugarbeet disease research

Minnesota and North Dakota rank first and second in production of sugarbeet, providing 54 percent of the nations's supply. In 1998, sugarbeet growers in North Dakota and Minnesota lost $113 million to a Cercospora leaf spot epidemic. Some isolates of Cercospora were found to be resistant and/or tolerant to the benzimidazole and triphenyltin hydroxide fungicides. From 1999 through 2002, the EPA has granted our researchers request to use Eminent, a tetraconazole fungicide, to control Cercospora leaf spot. The average number of fungicide applications applied per acre was reduced from 3.74 in 1998 to 2.6 in 2002, and Cercospora control was good to excellent in most fields.

Rhizomania and Rhizoctonia are also becoming more severe in sugarbeet fields. Management strategies are being developed to better manage these diseases using resistant varieties, and fungicides where applicable.

Researchers tested a prediction model for timing fungicide applications and tested different fungicides that will control Cercospora including resistant and /or tolerant strains. This has lad to the full registration of two new effective strobilurin fungicides, Headline and Gem. Efforts are still in place to have a full label for Eminent to be used in an alternation program with the strobilurins to control Cercospora and manage fungicide resistance. Researchers in North Dakota, Minnesota, and Montana are also looking at control strategies that integrate disease resistant crops and timely fungicide applications.

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

Institution NDSU
State North Dakota

Check one: **X** **Multistate Extension Activities**
____ Integrated Activities (Hatch Act Funds)
____ Integrated Activities (Smith-Lever Act Funds)

	Actual Expenditures
Title of Planned Program/Activity	**FY 2002**
Sugar Beet Program	66,000
Value Added Programs	22,000
TOTAL:	

Form CSREES-REPT (2/00)

F. INTEGRATED RESEARCH AND EXTENSION ACTIVITIES

Renewable Resources

EDUCATION:

* Cow/calf management and 12-month grazing and forage planning workshops (two- and three-day): Six intensive grazing and forage sessions were held in North Dakota for livestock producers. Ranchers learned to improve their rangeland management skills, develop year-long forage use strategies, and matching cow/calf nutrient needs with the range, pasture, and hayland resources. There were 115 ranchers participating in this program. More than 60 percent of the participants were planning to add new range improvement practices, and over 90 percent planned to implement the training strategies learned in the workshops. These workshops involved the educational opportunity to effect the management of 34,417 head of cattle (cow-calves and yearlings) and 235,250 acres of range and pastureland in North Dakota and northern tier counties of South Dakota.

* Rangeland Resource In-service Training to mentors, coaches, and teach within the Cooperative Extension Service and Natural Resource Conservation Service (two and three-day workshops): This program was a SARE funded project that took place in 2001 and 2002. Seventeen extension agents and 19 NRCS staff from North and South Dakota participated in this education opportunity. The program entitled four 2 or 3 day in-service training workshops, emphasizing hands-on evaluation and planning management of our western rangeland resources of the Dakotas. All participants were required to complete a ranch management plan of an existing operation for the final training sessions using a mentor, coach and teach format. Surveys will be tabulated and summarized in 2003.

*Educating youth on the importance of the range resource: A four-day range youth camp was conducted in western North Dakota for youth interested in the range resource and range judging. Youth learned the importance of range to livestock producers, the environment community, and wildlife enthusiasts. They learned basic fundamental range management practices and how to judge the resource for health and value for forage and wildlife habitat. Twenty-three youth ages 13-18 participated in the four-day camp and over 100 participated in the State Range Judging Contest. We believe any involvement of youth in the importance of the range resource and fundamental needs for managing these lands will create a better-rounded adult.

RESEARCH:

*Nutritional composition and mineral status on native rangeland and introduced grass plants: The NDSU Extension Service in cooperation with the Animal and Range Sciences Department and Hettinger Research Extension Center has conducted three nutritional studies in western and south central North Dakota. This research has recognized nutritional composition and mineral status of 36 different grass varieties (20 cool- season and 16 warm-season grasses). These results will allow forage growers, livestock producers, and wildlife managers to select one or more grasses that fit their needs and goals to provide a more economically efficient operation. They can select a grass that fits a specific program and problem area. Example: if a livestock producers need to add spring and fall pastures and a summer haying field, they can select a grass that fits each specific need while providing nutrients and forage at optimal levels (meadow brome “Regar” for spring, switchgrass “Forestburg” for summer hay ground, Russian wildrye “Mankota” for fall use while complementing the native pasture for summer grazing). Mineral status was also determined for native prairie with overwhelming results showing copper deficiencies during the entire growing season, zinc deficiencies in many years after mid July, phosphorus deficiencies by early July on all rangelands except lowlands associated with adjacent uplands, and potassium

deficiencies after mid September. We also know calcium and iron are adequate during the entire growing season, and potassium high until mid September.

*Effects of sheep grazing using a multi-species and single-species grazing approach on leafy spurge infested rangeland: NDSU Extension Service, in cooperation with the Animal and Range Sciences Department and Hettinger Research Extension Center, conducted grazing trials on leafy spurge infested rangeland throughout North Dakota. Sheep effectively controlled leafy spurge after one year using a single species grazing approach and after three years using a multi-species grazing approach. Leafy spurge stem densities were reduced by 96 percent and 98 percent on single-species and multi-species grazing treatments, respectively, after seven years. Season-long grazing using a multi-species approach provided a quicker, more efficient grazing of leafy spurge than rotational grazing. However, both reduced leafy spurge stem densities by 99 percent and 75 percent, respectively, after seven years.

* Impacts of differing dormant-season grazing strategies on native rangeland herbage production and plant species composition: NDSU Extension Service, in cooperation with the Animal and Range Sciences Department and Hettinger Research Extension Center, are conducting a dormant-season grazing trial on western rangelands of North and South Dakota. Full-use (50 percent degree of disappearance) dormant-season use treatment has either maintain or improved herbage production the subsequent year following treatment compared to properly stocked season long summer grazing. When two weeks of June grazing was treated to a full-use (50 percent degree of disappearance) dormant-season use treatment, subsequent years herbage production was increased 25 to 40 percent. Moderately stocked (30 percent degree of disappearance) dormant-season use treatment produced similar levels of herbage production in the growing season following treatment compared to properly stocked season long summer grazing.

Entomology Research and Education

Oil Seeds - Soybean

The soybean aphid, Aphis glycines, became established in North Dakota in 2001 following it's initial discovery in southern Wisconsin in 2000. Soybean acreage for North Dakota in 2001 was 2.15 million acres with a production value of $286 million (state ranking for production: 11; ND produces 2 percent of the nations soybean crop). Prior to the aphid's arrival, insect pest problems in ND soybean were uncommon and usually were grasshoppers and spider mites. Soybean fields were surveyed during mid-summer to monitor population development in the region. Survey and management information was presented through newsletters, news releases, internet, and field days. A publication on aphid management in North Dakota was prepared and distributed with funding and cooperation of the ND Soybean Council. Research/extension projects are focusing on the screening of current commercial varieties for tolerance to aphids, surveying for soybean aphid on the alternate host, buckthorn (Rhamnus sp.), population dynamics, and spatial distribution of the aphid in production fields. As the aphid becomes established, soybean growers will need to have a more aggressive insect management program, an understanding of the aphid's biology, and have available effective and economical management tools to address the problem. The recognition and development of host plant resistance in soybean to the soybean aphid can provide long term management opportunities with reduced reliance on the use of insecticides.

Small Grains

A regional survey for estimating wheat midge overwintering populations was completed for the seventh consecutive year. The project is funded by the North Dakota Wheat Commission. The outcome of these annual surveys has been the creation of an infestation risk map for use by wheat growers and agri-industry. Knowing the infestation risk prior to spring planting improves crop and budget planning.

The small grains IPM survey included scouting for the presence of grasshopper nymphs, cereal aphids, and cereal leaf beetle. The field survey information was made available through the weekly NDSU Extension Crop and Pest Report. This survey program evolved during the past two seasons to include interfacing of georeferenced data collection with mapping software now available. The maps summarizing the sampling data were used to graphically illustrate where pest problems were developing in the region. Pest problems included the insects already mentioned and numerous cereal diseases.

Corn

A degree-day model for predicting emergence of univoltine European corn borer (ECB) was developed. This improves our ability to identify when the most serious threat from corn borer can occur in the field and to schedule field scouting activities to assess management needs. ECB yield-loss studies provided have found no evidence to suggest differing levels of damage are inflicted by univoltine borers compared to bivoltine borers. The information is being incorporated into a regional project that will place modeling of ECB degree day predictions, crop development, and management recommendations over the entire U.S.

Oil Seed crops - Sunflower

A second sunflower survey coordinated by NDSU and supported by the National Sunflower Association was conducted in September for North and South Dakota, and Minnesota. In addition, the survey was expanded to Texas, Kansas, Nebraska, and Colorado with cooperation from NDSU extension specialists. Summaries of the results will be made available in January through the internet. The internet posting is being coordinated by NDSU Extension Specialist, Jon Nowatzki. Agricultural Systems and Biosystems Engineering Department. The insect survey component is being summarized and presented at the National Sunflower Association Sunflower Research Forum, January 16-17, 2003. The paper is: Insect Incidence and Damage to Sunflower from Texas to North Dakota Based on the 2002 Sunflower Crop Survey. L. D. Charlet, P. A. Glogoza, and T. Gross.

Sunflowers have a unique set of insect pest problems. In general, the key insect pests feed almost exclusively on sunflower. A region-wide survey of sunflower fields was conducted in September. The survey, sponsored by the National Sunflower Association, surveyed fields to estimate yield, classify production practices, and identify and rate weed, disease, and insect problems. Using the georeferenced data, insect pest problems and their area of concentration were illustrated across North and South Dakota as an educational tool for emphasizing key pest issues for the coming year. The Lygus bug, a plant bug that has severely impacted confectionary sunflower in the region, was one insect focused on in the survey. Seed damage was found throughout the region at levels that could result in seed rejection for use in food. An extensive research effort has helped define the treatment threshold, identified highest risk growth stages, and documented the time of

season when Lygus migrate into fields. The management recommendations formulated during this time have improved regional quality based on anecdotal accounts from processors. Future surveys are planned to document the impact and incidence of this and other insect pests.

Oil Seed crops - Canola
Canola management studies focusing on the crucifer flea beetle are being coordinated by Jan Knodel, NDSU extension pest management specialist. Insecticidal control in the form of seed treatments and foliar applications were evaluated. Seed treatments provide the greatest level of protection; however, the decision to use treatments needs to be better documented. The IPM crop and pest survey has implemented a spring and late summer survey to attempt to develop risk information on flea beetles.

North Central Region Pest Management Center
North Dakota Statewide Pesticide Use Survey. A statewide, enterprise level, major and minor crop, pesticide use survey for the 2000 cropping year has been published and distributed. The publication is: Glogoza, P., M. McMullen, R. Zollinger, A. Thostenson, T. DeJong, W. Meyer, N. Schauer, J. Olson. 2002. Pesticide Use and Pest Management Practices for Major Crops in North Dakota - 2000. NDSU Extension Service, Extension Report-79. 90p. Several compliments from other state liaisons around the U.S. have been received, along with inquiries regarding the survey process and cost.

Documenting pesticide use for key regional crops included the publication of the sugarbeet weed and insect control information. These reports are coordinated by NDSU Sugarbeet weed control specialist, Dr. Alan Dexter. Published from 2001 were: Survey of Weed Control and Production Practices on Sugarbeet in Eastern North Dakota and Minnesota - 2001. A. G. Dexter and J. L. Luecke. Sugarbeet Research and Extension Report.Vol 32, p 35; Survey of Weed Control and Production Practices on Sugarbeet in Western North Dakota and Eastern Montana - 2001. A. G. Dexter and J. L. Luecke. Sugarbeet Research and Extension Report. Vol 32, p 64; Survey of Insecticide Use in Sugarbeet in Eastern North Dakota and Minnesota - 2001. A. G. Dexter and J. L. Luecke. Sugarbeet Research and Extension Report.Vol 32, p 208; Survey of Insecticide Use in Sugarbeet in Western North Dakota and Eastern Montana - 2001. A. G. Dexter and J. L. Luecke. Sugarbeet Research and Extension Report.Vol 32, p 225; Survey of Fungicide Use in Sugarbeet in Eastern North Dakota and Minnesota - 2001. A. G. Dexter and J. L. Luecke. Sugarbeet Research and Extension Report.Vol 32, p 257; Survey of Fungicide Use in Sugarbeet in Western North Dakota and Eastern Montana -2001. A. G. Dexter and J. L. Luecke. Sugarbeet Research and Extension Report.Vol 32, p 261. Similar reports fro 2002 are being prepared for publication in January, 2003. These reports can be accessed through the internet at: http://www.sbreb.org/research/research.htm.

The NCPMC liaison worked closely with the IPM coordinator, Dr. Marcia McMullen in developing and implementing the statewide IPM Crop Survey program. The survey was modified to include five crops and their key pests. The changes in the survey produced some problems for timing all the field activities. However, the weekly information was summarized and published in a timely fashion through the internet and the weekly NDSU Crop and Pest Report. The NCPMC liaison coordinated the data summary, mapping, and internet posting of the information. Dr. Glogoza already coordinates the weekly NDSU Crop and Pest Report newsletter. To see results of these efforts, visit: http://www.ag.ndsu.nodak.edu/aginfo/ndipm/ and

http://www.ag.ndsu.nodak.edu/aginfo/entomology/ndsucpr/index.htm. A poster presentation summarizing this effort was presented at the Entomological Society of America Annual Meeting held in Fort Lauderdale, November 18-20, 2002. A similar poster has been submitted for the Fourth National Integrated Pest Management Symposium/Workshop to be held April 8-10, 2003, in Indianapolis, Indiana.

NDSU hosted three EPA representatives during the third week of June (Len Yourman, Plant Pathologist, BEAD; Anthony Gilbert, Economist, BEAD; and, Arnet "Skee" Jones, Herbicide & Insecticide Branch Chief, BEAD). Dr. Glogoza coordinated activities during their visit. A workshop over 3 days was planned and presented to the three. They met with NDSU Extension specialists from agronomy, weed science, plant pathology and entomology (Drs. Berglund, Zollinger, Khan, Dexter, McMullen, Bradley, and Glogoza) to review cropping systems, pest problems and solutions. Crops emphasized during the training were sugarbeet, sunflower, wheat, flax, dry edible bean, soybean, and canola. The sessions were videotaped by NDSU Ag Communication staff at the request of EPA. An non-edited version summarizing all the sessions was provided to EPA for use in their HQ meetings.

The ND PMC project and NDSU hosted Leonard Gianessi, National Center for Food and Agricultural Policy (NCFAP) in August. Mr. Gianessi presented information on the GM crop issues facing US agriculture. He reported on the NCFAP reports on "Plant Biotechnology: Current and Potential Impact for Improving Pest Management in US Agriculture, An Analysis of 40 Case Studies." There was emphasis and much discussion on the use of GM wheat, potato, and sugarbeet. These three crops are currently facing the issue of GM crop usage. The topic has been hotly debated in the region by ND legislators.

North Dakota Crop and Pest Report
The newsletter is coordinated through the entomology office. Responsibilities include subscriber database, final editing, distribution, and web page publishing. There was an extensive reformatting of the web page for the newsletter to improve access of the information in a timely and more appealing fashion
http://www.ag.ndsu.nodak.edu/aginfo/entomology/ndsucpr/index.htm) Published information is regional in scope and distributed to clientele in neighboring states.
Entomology Updates for North Dakota - An extension entomology web site has been developed to provide current information on insect pest management issues being faced within the region. The site provides links to relevant information that often is in more detail than newsletters, extension circulars, and other outlets may provide. Unique topics addressed during this reporting period were soybean aphid management, and West Nile Virus and mosquito management, fall invading insects, and others.
(http://www.ag.ndsu.nodak.edu/aginfo/entomology/entupdates/index.htm).

Integrated Beef Research Extension Activities

Interest in using annual legumes, such as field peas, in farming operations in the Northern Plains is increasing. Field peas and other annual legumes offer crop rotation benefits such as nitrogen fixation and disease resistance. Field peas can be harvested either as a forage or as a grain. Interest in using field pea grain in diets for beef cattle and sheep is also increasing as field pea

acreage increases.

Field pea grain is high in protein (approximately 23 percent crude protein). Data collected at North Dakota State University indicates field peas are high in energy (equal to corn) when fed to growing and finishing lambs. In addition, they can be used as a replacement for corn in diets for growing calves and as a replacement for corn as a supplement for forage-based beef cattle diets. In receiving diets for beef calves, field peas have increased feed intake and performance of weaned calves when compared to other cereal grains. Field peas have also been used successfully as an ingredient in creep feeds for calves grazing native range.

Scientists and extension personnel at North Dakota State University have used this information extensively in producer meetings throughout the state. In addition, two extension publications have been produced which detail various aspects of field pea use in livestock diets.

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

Institution NDSU
State North Dakota

Check one: __ **Multistate Extension Activities**
__ **Integrated Activities (Hatch Act Funds)**
_X_ **Integrated Activities (Smith-Lever Act Funds)**

Check one: __ **Multistate Extension Activities**
_X_ **Integrated Activities (Hatch Act Funds)**
___ **Integrated Activities (Smith-Lever Act Funds)**

	Actual Expenditures		**Actual Expenditures**
Title of Planned Program/Activity	**FY 2002**	**Title of Planned Program/Activity**	**FY 2002**
Renewable Resources	9,000	Renewable Resources	17,000
Beet Education	16,000	Beet Education	21,000
Entomology Education	11,000	Entomology Education	4,000
TOTAL:		TOTAL:	

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