

# **ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS**

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

Federal Fiscal Year 2003  
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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, oats, sunflower, barley, all dry edible beans, pinto beans, navy beans, canola and flaxseed. The state ranks second in production of all wheat, lentils and honey; and third in sugarbeets and rye. Exports of North Dakota commodities and products are valued at \$1.2 billion. Crop production is critically important to the economy of the Northern Great Plains. Cash receipts from crops provided more than 3.5 billion to the economic base of North Dakota in 2003. 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 17 percent of total agricultural cash receipts--\$653 million in 2002. 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. 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 53,000 acres in 2003. Dry peas have increased from about 2,000 acres to more than 155,000 acres during the same period. Canola increased from 20,000 acres to 1.3 million acres. North Dakota, despite its northern climate, has 2.7 million acres of soybean and 1.2 million acres of corn. Potato is the highest volume vegetable crop grown in the North Central region and exceeds \$450 million in value. Predominant cultivars grown include Red Norland, Dakota Pearl, and NorValley which were developed by the potato breeding program at NDSU. NDSU is the lead U.S. institution for flax variety development and testing. Trials are coordinated throughout the region, including Canada.*

*NDSU researchers continue to develop genetically improved varieties of major crops as well. Those varieties possess improved agronomic performance and quality and have a major economic impact on the state and region through increased yield and improved disease resistance and quality. Varieties released by NDSU in 2001 had an annual economic impact based on increased yield alone of about \$30 million annually. Alsen, a hard red spring wheat variety released in 2000, is the first hard red spring wheat variety which combines high quality and good agronomic characteristics with Type II resistance to Fusarium head blight. This disease has caused over 100 million per year in losses to the HRSW crop. In addition to its impact in North Dakota, where it is sown on about 38*

percent of the wheat acreage, the variety will also have an impact in South Dakota, Minnesota, and to a lesser extent, Montana. In areas where wheat scab is a major problem, Alsen constitutes almost 60 percent of the spring wheat acreage. Dapps, another hard red spring wheat variety, was released in 2003 and had excellent quality with average yield and test weight. In 2003, NDSU released hard spring wheat cultivars were grown on nearly 60 percent (3.8 million acres) of the N.D. wheat acreage. The oat variety "HiFi" released in 2001 by NDSU produces grain yield and quality equal to the highest yielding cultivars and the grain is 30 percent higher in soluble fiber concentration than other cultivars. The increased soluble fiber content is a valuable health trait for human diets. Dry bean cultivars developed at NDSU are the dominant cultivars grown in the region. "Norstar" navy bean is grown on 30 percent of the acreage while "Maverick" pinto bean exceeds 50 percent. These cultivars exceed over \$50 million in 2002 in North Dakota alone. Genotypes developed in this program have reduced the fungicide use in the region resulting in less input costs and less pesticide in the environment.

Researchers also focus on improved crop management. For example, researchers in southwestern North Dakota evaluated the effect of various planting dates on sunflower. Based on their results, 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.

NDSU specialists work directly with producers to improve their farms. The North Dakota Dairy Diagnostic program helps producers assemble teams of experts that will help identify key roadblocks to production and profitability. The program's intent is not only to enhance dairy farm profit, but to develop strategic alliances between the dairy and its many providers. Additional benefits include: methods of evaluating business growth, establishing long-term business relationships, reducing professional barriers, and improving communication with business partners. Fifty-five farms have participated. On one farm, changing from traditional farm-raised forage system to purchasing dairy-quality alfalfa from a North Dakota irrigated alfalfa grower cut feed costs by using less supplemental dietary protein. On a herd of 40 cows, the combined effects of cash savings and additional income from more milk increased their annual income by \$20,551. On another farm, implementing diagnostic team recommendations increased milk production by 6.5 pounds per cow per day on a 55-head dairy. The increased production boosted 2003 farm net income by \$12,539.

NDSU extension specialists helped the Dakota Lamb Growers Cooperative develop specifications for "Dakota Lean Lamb" and "Natural Lamb." Additional assistance was provided in the facilitation of informational meetings for the cooperative, initial newsletter preparation, a sheep school on lamb grading and feeding, an informational session on shearing, and continued advisory support when needed. Two extension specialists serve on the advisory board to the cooperative. 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. The cooperative controls approximately 20,000 lambs. 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 large customers, the cooperative is now projecting 300 lambs per week marketed.*

*A North Dakota Reserve Veterinary Corps was initiated in conjunction with the N.D. State Veterinarian. In 2003, twenty-four practitioners were trained and equipped through the Corps. The veterinary practitioners were trained 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. Other states such as Maryland are organizing private veterinary response teams. In a related program, all agricultural extension agents were familiarized with animal and plant diseases, trained in incident command and familiarized with the extension disaster recovery plan. County agents were not trained to be first-responders, but were trained to assist the county incident commander. Because agricultural agents reside in every county of the state, they are a key resource in the monitoring, surveillance, and recovery efforts involved in a bioterroristic event*

## **Program 1: Competitive and Profitable Crop Production**

### **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 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 always 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 a few 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 53,000 acres in 2003. Dry peas have increased from about 2,000 acres to more than 155,000 acres during the same period. Canola increased from 20,000 acres to 1.3 million acres. North Dakota, despite its northern climate, has 2.7 million acres of soybean and 1.2 million acres of corn for grain

production, which is greater than the acreage of barley, an older traditional crop in the region. Potato is the highest volume vegetable crop grown in the North Central region and exceeds \$450 million in value. Predominant cultivars grown include Red Norland, Dakota Pearl, and NorValley which were developed by the potato breeding program at NDSU. NDSU also is the lead U.S. institution for flax variety development and testing. Trials are coordinated throughout the region, including Canada.

**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 genetic selection and development of adapted varieties 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 use, 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. Because 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.

The development of pesticide adjuvants has directly led to increased pesticide efficiency and reduction in applicator rates. The application technology program at NDSU had led to reduction in spray volume and nozzle design which greatly increase application efficiency, reduce risk from pesticide drift, and decreased environmental concerns.

**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, developed several programs to describe varieties, production and maintenance 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 stimulate independent thinking and develop teamwork by asking students to address problems that 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, 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.

For instance, a computer program known as Weed It, (weed information transfer), has been developed to summarize more than 30 years of weed control research results. A land manager can determine the optimum weed control methods by entering known variables such as crop, weed species and growth stage, soil type, etc. The program then shows the user chemical and cultural control options, expected cost and potential affect on yield. The Pesticide Program at NDSU routinely trains 1,500 to 2,000 commercial and private applicators per year in the proper handling and application of crop and home use pesticides. This program is recognized nationally for the high quality of its training programs and the resulting outstanding safety record for pesticide use in the state. More than 20,000 commercial and private applicators have been trained by this program.

Today, food production is global in nature. For some producers, especially older ones, this can often 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, 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 genetic research programs in most of the region's major crops with the goal of releasing new varieties or develop genetic materials for use by other programs. 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 and cereal scientists, which are located in the Department of Plant Sciences, cooperate extensively with their counterparts in the Departments of Plant Pathology, Entomology 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 hullless 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 in 2000, is the first hard red spring wheat variety which combines high quality and good agronomic characteristics with Type II resistance to Fusarium head blight. This disease has caused over 100 million per year in losses to the HRSW

crop. In addition to its impact in North Dakota, where it is sown on about 38 percent of the wheat acreage, the variety will also have an impact in South Dakota, Minnesota, and to a lesser extent, Montana. In areas where wheat scab is a major problem, Alsen constitutes almost 60 percent of the spring wheat acreage. Dapps was released in 2003 and had excellent quality with average yield and test weight. In 2003, NDSU released hard spring wheat cultivars were grown on nearly 60 percent (3.8 million acres) of N.D. wheat acreage.

Other varieties were released for use by oat, durum, six-rowed barley, flax, soybean, and dry edible bean 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-rowed barley variety "Drummond" has been accepted by the American Malting Barley Industry as a malting variety and will provide additional benefit to producers statewide. 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, quality, or 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. NDSU is the only public institution that develops corn inbreds adapted for use by industry in the northern plains region. This program has greatly increased corn germplasm for hybrids adapted to the northern region. NDSU lines are distributed elsewhere in the United States and world for evaluation.

The oat variety "HiFi" released in 2001 by NDSU produces grain yield and quality equal to the highest yielding cultivars and the grain is 30 percent higher in soluble fiber concentration than other cultivars. The increased soluble fiber content is a valuable health trait for human diets.

Dry bean cultivars developed at NDSU are the dominant cultivars grown in the region. "Norstar" navy bean is grown on 30 percent of the acreage while "Maverick" pinto bean exceeds 50 percent. These cultivars exceed over \$50 million in 2002 in North Dakota alone. Genotypes developed in this program have reduced the fungicide use in the region resulting in less input costs and less pesticide in the environment.

Fusarium head blight (FHB) has reduced barley production in the region in both quality and quantity. NDSU researchers currently have several lines with resistance to (FHB). The release of a FHB resistant variety will have a major impact on barley production, especially in eastern and central North Dakota.

**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 fifth 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 over 390 other woody accessions, many at multiple sites in the state. NDSU researchers collaborate in national and regional nursery plant evaluation programs. Sixty-nine new accessions were added to state-wide trials in 2003.

**Impact:** NDSU has released 28 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. For instance in 2003, commercial inventory in the region was selected largely based on recommendations from NDSU's program and its collaboration with researchers across the region. Evaluation reports on over 150 cultivars were submitted to nurseries in 2003.

Two winter-hardy woody plants were released in 2003 for commercial production. "Horizon" Manchurian Alder has both superior winter hardiness and drought tolerance to currently available Alders. "Torch" hybrid buckeye grows more rapidly than the Ohio Buckeye, has aesthetically pleasing dark-green palmate leaves in the summer and brilliant orange-red autumn color. An American elm and hybrid juniper were also released for commercial production.

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

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

**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 hold or invite producers to area production meetings to fine-tune their production skills.

Cooperating institutions and organizations: LaMoure County Extension Office, Allied Agronomy Services of Edgeley, Larson Grain Company, Witt Consulting of LaMoure, Dakota Prairie Ag, Edgeley, National Sunflower Association, North Dakota Soybean Council, soybean and sunflower seed companies, NDSU oat breeder Mike McMullen, NDSU soybean breeder Ted Helm, NDSU

Carrington Research and Extension Center, ADM Plant of Enderlin, LaMoure County Ag Improvement Association and producers Tom Kiecker of Edgeley and Dennis Feiken of LaMoure.

**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 1994, LaMoure County had fewer than 9,000 acres in soybeans and more than 228,000 acres in hard red spring wheat. By 2003, soybean acreage had increased to more than 202,000 acres and hard red spring wheat acres had decreased to 105,000. The economic impact from this change was approximately \$2.5 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 Extension Service, Montana State University 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. In addition, 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. In 2003, producers utilizing good rotations to control soil-borne fungal diseases reported 80 bushels per acre of barley that met malting standards. Malting barley will bring about 50 cents per bushel premium or in this case, \$40 per acre return over feed barley.

**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, NDSU Extension Service, National Sunflower Association, North Dakota Board of Agricultural Research and Education, USDA Agricultural Research Service, 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: NDSU Extension Service, NDSU plant pest diagnostician, extension service plant pathologist, extension service entomologist and participating area extension specialists.

**Impact:** Thirty-seven 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 stereoscope, 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. WSMV was not found in 2003 in fields where producers applied the recommended practices for controlling this disease. In 2003, adult Dectes longhorn beetles were identified using equipment in the Plant Diagnostic Lab. Pesticide applications are not an option for controlling this pest. It was recommended to the four producers who participated in the identification to not spray for the pest but to harvest early to avoid severe yield loss. Producers saved \$11 per acre from ineffective pesticide applications on 800 acres of sunflower, reduced harvest losses from, and estimated 250 pounds per acre to 100 pounds per acre. Tan spot in spring wheat was identified early in 11 producer fields. It was recommended that the addition of a fungicide at \$5.00 per acre be included with their herbicide applications. Producers claim that yields in treated fields were 3 to 5 bushels higher than untreated fields. These 11 producers treated a total of 6,000 acres of wheat for tan spot.

**Source of federal funds:** Smith-Lever

**Scope of impact:** Statewide extension

**Key Theme - Innovative Farming Techniques: No-till Equipment Selection and Management Practices**

The area extension cropping systems specialist, Hettinger County extension agent, NDSU extension agriculture engineer, and a Dickinson Research Extension Center scientist developed a demonstration no-till drill designed to incorporate the most current ideas known about the biology of seed germination and its response to the environment during early growth and establishment. Dr. John Baker, New Zealand inventor of the Cross-slot opener, addressed the direct seeding seminar. A demonstration was conducted in an indoor arena because of winter weather.

Cooperating institutions and organizations: Hettinger County Extension Service, North Dakota Barley Council, North Dakota Dry Pea and Lentil Association, Dickinson Chamber of Commerce and Agriculture, Dickinson Research and Extension Center, NDSU Extension Service.

**Impact:** Two hundred twenty-five producers attended a direct seeding seminar. Three producers traveled from northeast Colorado to attend the program. Twenty-two producers from adjacent states attended. Of the producers surveyed after the program, 87 percent expressed the desire to learn

more about low-disturbance seeding and to view a demonstration of various styles of drill openers. Demonstrations are in development for spring 2004.

**Source of federal funds:** Smith-Lever

**Scope of impact:** Multi-state ND, MT, 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 may be the best management option. However, the development of midge-resistant hybrids has not occurred because natural populations of the pest are often too low to provide an adequate test. Planting over several dates and in locations with a history of midge infestation maximizes the insect pressure. Techniques using natural midge populations to test sunflower germplasm for midge preference, for harmful effects on midge larvae and for midge tolerance have been developed. Artificial infestation techniques can be used for limited testing. A technique to simulate damage using a synthetic plant auxin applied to seedling sunflower has the potential of identifying midge tolerant germplasm and would allow large amounts of germplasm 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, National Sunflower Association, and SBARE

**Scope of impact:** Sunflower midge is widely distributed in eastern North Dakota, western Minnesota, and adjacent areas of Manitoba and is found in parts of South Dakota. Localized and occasionally widespread outbreaks occur.

**Key Theme - Emerging Infectious Diseases: Sugarbeet Disease Research**

North Dakota ranks second in the production of sugarbeets, providing 17 percent of the nation'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 2003, the EPA has granted our sugarbeet extension specialist 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 2.75 in 2003, 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 were applicable.

**Impact:** Researchers 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. Growers are now successfully controlling Cercospora leaf spot without losing millions of dollars as they did in 1998. Researchers in North Dakota, Minnesota and Montana are also looking at control strategies that integrate disease resistant crops and timely fungicide applications to manage new and emerging diseases.

**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**

Demand and market opportunities for value-added wheat-based products have been growing rapidly over the past few decades. Broad-based economic growth in developing countries has given rise to an overwhelming demand for high quality wheat, resulting in an escalation of global agricultural trade. Presently, buyers and consumers are more cognizant to quality, and they have well-defined quality specifications. In response to this demand of the global market, NDSU researchers are seeking new quality criteria in hard red and hard white spring wheat genotypes, which could broaden the application of these wheats for myriads of different wheat-based products.

**Impact:** Researchers identified key quality characteristics and identified several wheat genotypes with potential for frozen dough and noodle production. Significant improvement in quality has been observed in bread, frozen dough and noodle products when wheat starch with reduced amylose content is used. Research continues to identify starch requirements necessary to obtain specific characteristics in different wheat-based products. 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 Coalition, North Dakota State University Extension Service, various dairy-related industry, dairy farm families, and North Dakota Agricultural Products Utilization Commission (APUC). This advisory team approach demonstrates both empirical and financial success. The economic impact realized by participating dairy farms provides convincing evidence for continued support. To accomplish that task, we continue to seek long-range funding.

**Impact:** The ND3P continues to add new participants, while other families graduate from the program to conduct the learned model on their own. New teams begin by preparing a set of attainable farm goals and implementing advisory team recommendations. With the help of the ND3P facilitator, together they monitor and measure the impact of the decisions adapted for the farm, the dairy enterprise, and the family. Nearly 14 percent of the current dairy farms have enrolled in the program.

Dairy is the original value-added agricultural industry. According to university research, for each dollar spent in dairying, the community can expect it to be reinvested from 2.67 to 7 times in the form of locally purchased supplies, hired labor, equipment, taxes, etc.

The program's intent is not only to enhance dairy farm profit, but to develop strategic alliances between the dairy and its many providers. Many intangible benefits are derived as a result of ND3P participation and include: methods of evaluating business growth, establishing long-term business relationships, reducing professional barriers, and improving communication with business partners.

Accomplishments from selected farms. (55 farms have been involved in the program)

1. By changing from their traditional farm-raised forage system to purchasing dairy-quality alfalfa from a North Dakota irrigated alfalfa grower, the dairy diagnostic team help this farm to cut feed costs by using less supplemental dietary protein. On a herd of 40 cows, the combined effects of cash savings and additional income from more milk increased their annual income by \$20,551.

2. Implementing diagnostic team recommendations increased milk production by 6.5 pounds per cow per day on a 55-head dairy. Result: Increased 2003 farm net income by \$12,539.
3. The advisory team helped this dairy farm wrestle with two years of financial difficulties. Together they developed a financial plan of restructuring loans for the entire farm that secured operating loans for the past year. Management changes included developing a purchase order system to control expenses, an advisory group to direct and monitor ration/veterinarian issues, revised structure for more efficient use of labor and reduced costs, and restructured the calf rearing operation to include more appropriate management protocols. After one year the farm was able to pay all of its yearly expenses and pay down 20 percent of the loss it had incurred the previous two years.
4. Retooled feed procurement and ration delivery to lower feed cost by \$35.28 per day on a herd of 56 cows, while increasing milk production an additional 6 pounds per cow per day. Changes also improved the component yield of milk fat from 3.92 percent to 4.2 percent and reduced somatic cell count from 315,000 to 260,000. As a result, dairy enterprise annual net income increased by \$5,007.
5. Raised milk components and maintained milk yield after implementing the advisory team suggestions. More specifically they increased milk fat percentage from 3.7 percent to 3.9 percent, increased milk protein from 2.84 percent to 3.2 percent, and increased milk quality by reducing somatic cell count from 400,000 to 357,500. Annual net income increased by \$11,049.
6. This producer used ND3P to help plan and design a transition facility. Moving from a stanchion barn to a parlor and housing confinement increase cow comfort that resulted in increased milk production and improved lactating cow pregnancy rates, while reducing the physical demands on the operator. By reducing the physical challenges he decreased the incidence of recurring back pain so that this farmer will be able to continue to operate his dairy and improve personal health. With only a few months of information, improved health of the cows has increased milk production an additional 5 to 10 pounds per cow per day and reduces the physical barriers of this chosen lifestyle.
7. With the help of the diagnostic team facilitator's analysis, they were able to justify the addition of a mixer wagon to this dairy operation. The enhanced ability to deliver a total mixed ration increased milk production 18 pounds per cow per day. This herd of 38 cows increased milk production from a daily average of 35.8 pounds to 53.8 pounds yielding increased annual enterprise income of \$25,034.

(Assumptions: Value of increased production was based on \$12.00 per hundredweight of milk for a 305 day lactation. Milk premiums adjustments were based on \$3.25 per cwt for change in protein yield, \$1.22 per cwt. for butterfat yield, and \$0.002 per 1000 SCC reduction.)

**Source of federal funds:** Smith Lever

**Scope of Impact:** State specific

**Key Theme - Dairy Retention and Sustainability**

The North Dakota Dairy Task Force is a 'grass-roots' producer-driven effort to revitalize the dairy industry. North Dakota State University Extension Service, Animal and Range Sciences Department

have teamed up with the North Dakota Association of Rural Electric Cooperatives to provide momentum to this very important effort. The task force has prepared and promoted a vision statement for the industry, printed a mission statement, established a set of goals, defined strategies, and assigned working committees.

**Impact:** Dairy remains the state's second leading animal industry. However, declining numbers and results of a statewide survey suggest the entire dairy marketing infrastructure is at risk. Action is paramount and must be decisive to stem the decline in dairy numbers. It is well established that the multiplier for economic impact of dairying ranges from 2.67 to 7. Projections to the year 2020 for the U.S. dairy industry suggest that only the Upper Midwest has the significant opportunity for dairy growth. Since North Dakota agriculture is well suited to animal production, a plan of work has been developed and resources are being collected to positively impact the future of dairy in our state.

The plan of work is a collaborative effort by the members of the North Dakota Dairy Coalition (NDDC). It has been divided into three components: A.) Expansion and retention of existing North Dakota dairy farms, B.) Recruitment of non-resident dairy operations, C.) Investment by external interests. The scope of these plans requires that it be divided among several agencies to accomplish this task. Because the NDSU Extension Service and the Department of Agriculture - Dairy Division have a long-standing tradition of supporting local dairy producer and processor needs, they delegated the leadership and responsibility for existing needs for expansion and retention of existing North Dakota dairy farms. The NDDC will focus its energies on the component dealing with recruitment of non-resident dairy operations and potential dairy farms that reside beyond our borders. As progress is made, NDDC will also address the more specialized and unique recruitment needs for investment by external interests, the recruitment potential of other investors not currently involved in a dairy enterprise. This is a works-in-progress.

**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. In 2003, a total of 78 producers 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" 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.

In the winter and early spring of 2003, a major education initiative was conducted by the extension service including county agents, private veterinary practitioners and the extension veterinarian. The major focus of the education initiative was appropriate vaccination of horses.

**Impact:** An outbreak in 2003 never occurred. For the longer term, 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 helped the Dakota Lamb Growers Cooperative develop specifications for "Dakota Lean Lamb" and "Natural Lamb." The cooperative has been selling lambs on the East Coast since 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. Today, consumers include big chain supermarkets in the east. Currently, Dakota Lamb Growers Cooperative is shipping natural boxed and carcass lamb. New sausage products have also been developed. Assistance was provided in the facilitation of informational meetings for the cooperative, initial newsletter preparation, a sheep school on lamb grading and feeding, an informational session on shearing, 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. The cooperative controls approximately 20,000 lambs. 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 large customers, the cooperative is now projecting 300 lambs per week marketed.

**Source of federal funds:** Smith-Lever

**Scope of impact:** SD, MN and MT

**Key Theme - Agricultural Profitability: Feedlot Development in North Dakota**

Numerous demonstration projects were conducted to determine the value of feeding producer-owned cattle in North Dakota and demonstrate that cattle can be cost effectively fed to finish in North Dakota. With initial 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 for building 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 7,000 head in North Dakota feedlots. With help from extension specialists and agents, they realized a return of more than 31 percent within 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 300 producers attended extension feedlot schools in the last three years. Lenders are exploring additional financing of cattle, feed, and cattle feeding

facilities in North Dakota and have creatively increased funds for expanding feedyards. One participant estimated that better health practices, bunk management and feeding practices cut cost of gain by up to 5 cents per pound. Another participant has increased the number of cattle owned for feeding from 1000 head to 5000 head through the use of custom feedlots. Privately owned custom feedyards are being built in a response to increased education and public funds for improving water quality vis reducing manure runoff.

**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 owning a local meat processing plant with sole source delivery rights, and a limited, limited liability partnership (LLL) for owning cattle for feeding to finish. 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 (LLL).

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 owning a processing company for producing meat for a regional 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 and Sheyenne Valley Brand 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: Consumers indicated they were interested in buying locally produced beef (64.3 percent would pay a premium). Quality was more important than price as the determining factor in buying beef (85.8 percent). More than 77 percent of the survey respondents found the product through in-store promotions. And more than 91 percent were interested in future purchases. Producers are considering purchasing shares in a multi-state beef processing cooperative. Another meat processing company developed by local cattle producers has started marketing fresh and processed meats via the Sheyenne Valley brand label.

**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. Job development was attained through building and operating a processing for harvesting, processing and cooking meat from animals grown in the local community. The new feeding ventures increased cattle fed a special diets specifically for the new processing plant. A home delivery business was developed to aid meat sales in the community.

**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 placental size and blood vessel growth in fetal growth and development in cattle and sheep. A recent focus of nutritional effects on pregnancy outcome and fetal and placental growth increases the scope of this research area.

**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 improvements 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 after 12 years of season-long grazing. A moderate season-long grazing intensity appears to maintain rangeland ecosystem functioning and range condition. After 14 years of continuous grazing and one year of simulated drought, basal cover of green needlegrass decreased while total and sedge basal cover increased. Total herbaceous yield trended down under intensive grazing and simulated drought. Additional research will build on early findings to provide grazing management recommendations for producers during times of drought.

**Source of federal funds:** Hatch

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

### **Key Theme - Bioterrorism: Preparing for Biological Terrorism**

Homeland security and more specifically biological terrorism are real threats for an agriculturally based state like North Dakota. There were two primary areas of programing in bioterrorism, the North Dakota Reserve Veterinary Corps and the training of all livestock and agronomic agents in bioterrorism.

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. 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.

Because agricultural agents reside in every county of the state, they are a key resource in the monitoring, surveillance, and recovery efforts involved in a bioterroristic event. All agricultural agents were trained utilizing a two-day course developed by the extension service.

**Impact:** A North Dakota Reserve Veterinary Corps was initiated. In 2003, twenty-four practitioners were trained and equipped through the Corps. The veterinary practitioners were trained 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. Other states such as Maryland are organizing private veterinary response teams.

Agents were familiarized with animal and plant diseases, trained in incident command and familiarized with the extension disaster recovery plan. County agents were not trained to be first-responders, but were trained to assist the county incident commander with education, communication, and recovery efforts.

**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 primarily on cattle and sheep. In addition to productivity realized by traditional, co-product and new feed regimens, considerable attention has been directed at sources, intake, and fates of metabolizable protein. Research has also addressed selenium metabolism and interactions between nutrition and pregnancy in domestic livestock.

**Impact:** Researchers learned that soybean hulls are just as effective as corn as a supplement for beef cows fed lower quality forage diets. Soyhull availability has increased dramatically in the state in the past five years as soybean acreage increases, and they are priced competitively with conventional supplements. Processing barley finer in backgrounding diets increased feed efficiency when total mixed rations were fed to growing steers. Field peas can be used as a portion of creep feeds for nursing calves with no negative effects on forage digestibility.

Bedding cattle during winter months resulted in greater weight gains, improved performance, and higher quality carcasses. Greater use of bedding may allow cattle feeders in northern areas to more effectively compete with feedlots in other regions of the country. Bedding also increased the nitrogen retention in raw and composted manure, which has important environmental implications for cattle feeders.

Processing flax by grinding or rolling improved cattle performance compared to feeding whole flax. Feedlot cattle fed barley-based diets responded positively to inclusion of escape or bypass protein.

Cattle fed feedstuffs containing high levels of selenium produced meat products higher in selenium. Beef produced under these conditions can be used to provide supranutritional levels of selenium in human diets.

Researchers also discovered that absorptive capacity of the gut increases with advancing pregnancy. Research in this area will lead to greater understanding of how nutritional requirements during pregnancy change, how to more efficiently feed gestating livestock, and ultimately improve production efficiency.

**Source of Federal Funding:** Hatch and Smith-Lever

**Scope of Impact:** Statewide research and extension

**Program 1**

Allocated Resources  
(\$ x \$1,000)

**FY03**

1862 Extension (\$)	Smith-Lever	658
	State	987
	FTE	23.5
1862 Research (\$)	Hatch	1,360
	State	2,000
	FTE	40

**Program 2**

Allocated Resources  
(\$ x \$1,000)

**FY03**

1862 Extension (\$)	Smith-Lever	322
	State	483
	FTE	11.5
1862 Research (\$)	Hatch	170
	State	250
	FTE	5

**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 eight years, more than 2,000 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. About 130 managers have been certified through the National Restaurant Association's ServSafe Certification Program. In follow up surveys, 85 percent reported they washed their hands more often when preparing food, 60 percent are more careful about cleaning and sanitizing, 50 percent had shared the workshop materials with other people, 28 percent are reheating foods to 165 degrees more often, and 17 percent reported using food thermometers*

*more often*

*After a food safety education program aimed at teens, the participants rated the importance of food safety 4.4 on a scale from 1 to 5. According to follow-up surveys, more than 83 percent reported washing their hands more often when preparing food, 66 percent were more careful about cleaning and sanitizing, 48 percent had shared their knowledge about food safety with other people, and 45 percent reported thawing foods in the refrigerator or microwave. About 16 percent reported using a food thermometer to measure the temperature of food more often and 36 percent had applied what they learned when preparing food for the public. Following a pilot project, copies of the curriculum were shared with the North Dakota Department of Health Division of Food and Lodging and 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. Some businesses provided an additional monetary incentive to students who had completed the training. As the result of USDA Integrated Research, Education and Extension Funding, the project is being implemented statewide.*

*NDSU developed the first multi disciplinary minor in food safety. After four years, 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.*

*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. Producers used fungicides as a management strategy on 900,000 acres of wheat and 160,000 acres of barley realized an average return of \$25 per acre, resulting in an additional \$26.5 million revenue to producers who used this strategy in 2003. The Extension Specialist wrote the Specific Exemption for use of the fungicide, which was sent to the ND Dept. of Agriculture and subsequently approved by EPA. 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.*

*NDSU specialists studied management practices to control the disease Sclerotinia in sunflowers. Consequently, producers in the north central region of North Dakota 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.*

*Based largely on NDSU research and outreach programs, 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.*

**Key Theme - Food Safety: Consumers - Native Americans**

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", initiated in 2000, 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. In 2003, the materials were adapted for use with refugees from Somalia, Bosnia and the Sudan, and hands-on classes were held with this target group.

Since 2000, more than 3,000 consumers have participated in the "Thermy" 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 (4 percent). About 96 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.

**Impact:** About 58 percent participated in a follow up class and survey. Eighty-seven 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 81 percent reported that they were feeling more confident they were serving safe food to their families as a result of using a thermometer. About 72 percent reported they had used their thermometer in the previous month. Of those, 22 percent had used the thermometers at least five times in the previous month. About 92 percent planned to use the refrigerator thermometer they received.

**Source of federal funds:** Smith Lever

**Scope of Impact:** Statewide Extension

**Key Theme - Food Safety: Consumers - Refugees**

In 2003, the “Thermy” food safety campaign targeted new Americans/refugee families, including people from Bosnia, the Sudan, Somalia and Vietnam living in Cass County, ND. On Survey I, all of the participants reported preparing meals at home for themselves or others at least once per week. About 46 percent reported preparing meals 9 or more times weekly, 22.7 percent reported preparing meals 7-8 times weekly, 17 percent reported preparing meals 5-6 times weekly, and 11.4 percent reported preparing meals 3-4 times weekly. The participants prepare food for audiences vulnerable to foodborne illness, including infants/children (79.5 percent), seniors/elderly (54.5 percent), pregnant women (69.3 percent) and immune-compromised (10.2 percent). After participating in the first session, about 97 percent of the participants were able to correctly list the “four steps to food safety” of the Fight BAC campaign: clean (97.7 percent correct), separate (96.6 percent correct), cook (97.7 percent correct) and chill (97.7 percent correct). After the first session, about 98 percent of the participants were able to correctly identify the safe internal temperature for ground beef (160 F). About 94 percent said they planned to use the food thermometer when they cooked.

**Impact:** We reached 98 percent of our original audience for the follow-up class. On the follow-up survey 88 percent indicated they had used the thermometer at least one time in the previous month; 56 percent had used the thermometer five or more times. About 99 percent planned to use the refrigerator thermometer.

**Source of federal funds:** Smith Lever

**Scope of Impact:** Regional Extension

### **Key Theme - Food Safety: Food Processing**

Because food-related businesses are a growing sector in the North Dakota economy, the NDSU Extension Service developed materials and partnered with other agencies to help ensure the safety of North Dakota-produced foods for the past 10 years. A resource binder, “Starting Your Food Business in North Dakota,” was developed by the NDSU Extension Service and the Institute for Business and Industry Development in partnership with the North Dakota Department of Agriculture. Available in all county extension service offices, the resource binder includes information on food industry rules and regulations regarding food safety/quality control. A Web site, “Food Entrepreneur: Guide to the Food Industry,” is regularly updated with information on food safety, testing/labeling and other issues: <http://www.ag.ndsu.nodak.edu/cdfs/foodent/entrpr.htm>

Workshops on “Acidified Foods Regulations” and “HACCP” (Hazard Analysis Critical Control Point) in partnership with the Food and Drug Administration (FDA) and US Department of Agriculture have been provided for food entrepreneurs and regulators. In 2003, more than 40 regulators, educators and representatives from food business attended all-day workshops detailing “Acidified Foods” regulations, food safety and packaging. “Nutrition Facts” labeling of North Dakota food products has been provided since 1994. Participants in the most recent FDA-sponsored “acidified foods” training showed increased knowledge in these areas: microbiology of processed foods, safe food handling/processing procedures, acidity testing and acidity levels of various foods, processing equipment, registration and process filing with the FDA and regional/state food processing issues

**Impacts:** More than 150 food products have been tested for acidity and water activity for compliance to federal regulatory standards. Several products did not meet the federal government standards for acidity and were re-formulated for safety. “Nutrition Facts” labels have been developed for over 300 North Dakota food products currently on the market.

**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 eight years, more than 2,000 food service managers and employees from restaurants, nursing homes, senior centers, hospitals, daycare centers and schools in over 100 different North Dakota cities have attended NDSU Extension Service food safety workshops held across the state. The four-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.

In 2003, 10 four-hour workshops covering all regions in the state were conducted with 220 employees and volunteer food handlers preparing and serving food in the congregate feeding program for North Dakota's Department of Aging Services. The workshops were based on the “Fight BAC” food safety campaign, with emphasis on current guidelines for “cleaning, separating, cooking and chilling.” About 59 percent of the participants had worked in the foodservice area for more than five years. Average test scores increased by 25 percentage points. About 84 percent indicated they planned to wash their hands more thoroughly, 73 percent planned to tell others what they learned, 71 percent planned to use a food thermometer more often, 65 percent planned to share materials with other people, 63 percent planned to use a food thermometer more often, 58 percent indicated they would change techniques of cooling large quantities of food, and 59 percent would change food preparation techniques to avoid cross contamination.

**Impact:** On follow-up surveys sent three months after the workshops, participants were asked which food handling practices they had changed as a result of attending the workshops. About 60 percent of the participants returned their surveys. Of those, 69 percent indicated they wash their hands more often, 60 percent had told other people what they learned, 60 percent had changed some of their food handling practices at home, 58 percent had put up the handwashing posters in their places of work, 53 percent were more careful about cleaning, 39 percent were monitoring their freezer/refrigerator

temperatures more closely, 34 percent were recording food temperatures during preparation and hot-holding, and 22 percent had changed their cooling procedures to use smaller containers/ice baths.

**Source of federal funds:** Smith Lever

**Scope of Impact:** Statewide Extension

**Key Theme - Food Safety: Teenage Food Handlers**

A five-lesson food safety curriculum, “Teens Serving Food Safely,” was developed and piloted in classrooms for students ages 15 to 19 in 2001-02. More than 300 students completed the lessons and passed the exam with a score of 80 percent or higher. 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. USDA Integrated Research, Education and Extension funding was received in 2002. In 2003, more than 100 educators, including extension agents and family and consumer sciences teachers from across North Dakota, participated in training sessions and received a copy of the curriculum.

**Impact:** According to follow-up surveys with teen food handlers, more than 83 percent reported washing their hands more often when preparing food, 66 percent were more careful about cleaning and sanitizing, 48 percent had shared their knowledge about food safety with other people, and 45 percent reported thawing foods in the refrigerator or microwave. About 16 percent reported using a food thermometer to measure the temperature of food more often and 36 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. Some businesses provided an additional monetary incentive to students who had completed the training and showed a certificate.

**Source of federal funds:** Smith Lever and Integrated Research, Education and Extension Grant funding

**Scope of Impact:** Statewide 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 foodborne illness outbreaks.

Initiated in 2002, the “Wash Your Hands” project has involved 3,347 children in grades K-12 in schools throughout North Dakota. The instructors use a fluorescing dye and ultraviolet light to show areas the students missed washing. 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 the 381 third graders participating in the program, about 96 percent of the students identified both soap and water as essential to hand washing and 86 percent correctly identified the time recommendation for hand washing (“as long as it takes to count to 20”). About 93 percent said they would wash their hands more carefully in the future. Among the 209 sixth graders participating, 65 percent reported they “always” wash their hands before they eat and 30 percent reported they “sometimes” wash their hands before they eat. About 32 percent reported they always use soap. About 96 percent of the sixth grade students correctly identified 20 seconds as the current recommendation for time spent washing hands. About 86 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 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:

- 51 percent of homemakers showed improvement in one or more of the food safety practices such as thawing and storing foods properly.
- 62 percent of participants at entry into the EFNEP program demonstrated acceptable food safety practices. At the end of the program, 82 percent of the 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 a 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:

- 80 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.
- 25 percent of the participants at entry level demonstrated acceptable practices of food resource management, compared to 58 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 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 satisfy 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 88 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 by an interdisciplinary team of faculty members, including extension faculty. 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 tuberosum*, 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: Managing Field and Storage Diseases of Potatoes**

NDSU researchers are studying six key storage and field diseases of potato: late blight, early blight, pink rot, black dot, silver scurf and ring rot. In addition, they are studying new and emerging diseases including tuber necrotic strains of potato virus Y and phytoplasmas. They will screen germplasm for resistance to many of these diseases and evaluate field and storage conditions and management techniques for reduction of disease incidence and severity. Control measures are

targeted for diseases that affect fresh and stored potatoes and include resistant varieties, fungicides, cultural practices and biological control. The researchers are also studying how and why pathogens that cause disease are becoming resistant to the fungicides used to control them.

**Impact:** Results from the research will help the potato industry implement control measures that improve quality and quantity of fresh and processed potatoes, and provide better and safer fresh and processed potatoes to the consumer.

**Source of federal funds:** Hatch

**Scope of impact:** Multi-state research

**Key Theme - Food Security: Biological Control - Sugarbeet Root Maggot**

Bio-based insect control research is aimed at development and optimization of application methodology for delivery of the insect-pathogenic fungus, *Metarhizium anisopliae*, to control the sugarbeet root maggot. Companion laboratory research is focused on determining application rates needed for effective and economical application of the fungus. 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, and is capable of causing yield losses of 40 to nearly 100 percent in the absence or failure of control measures. For nearly 30 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 - Sugarbeet Root Maggot**

Chemical insecticides are under frequent regulatory and public scrutiny, and some have the potential for causing harmful impacts to non-target and beneficial organisms in the agroecosystem. Therefore, the development of cultural strategies for management of agricultural pests is a worthy endeavor. 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. Essentially, the concept involves planting sugarbeet, the insect's preferred host, in previous-year sugarbeet fields (root maggot overwintering sites) to delay

or prevent their colonization of current-year sugarbeets in neighboring fields.

**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 - Sugarbeet Root Maggot**

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, *Beta vulgaris*, 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 bug (*Lygus lineolaris*) infestations have caused significant late-season injury in North Dakota and Minnesota sugarbeet fields in recent years. This project has been broadened to include three major components: 1) characterization of the seasonal activity and host sequence of Lygus populations in the Red River Valley; 2) quantification of the effects of feeding injury on sugarbeet yield and quality; and 3) development of safe, cost-effective tools for controlling Lygus in sugarbeet.

**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 when *Lygus* infestations are not at economically injurious levels.

**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: Preventative Pest Management - Sunflower Crop**

Many insects attack the sunflower crop. Pests of this crop are unpredictable, varying from year to year, although outbreaks of one or more of these pests can be disastrous for the crop in localized regions. Because it is highly desirable to develop new environmentally friendly, sustainable controls for insect pests in agriculture, we are identifying and developing host-plant chemicals for use in control of sunflower pests. We have isolated a number of terpenoid chemicals that influence selection of sunflower by female banded sunflower moths as a host to lay eggs on. Two of these chemicals are not volatile and appear to influence females only when they are on the plant. A number of volatile terpenoids are currently being tested for ability to attract female banded sunflower moth; if successful, these attractant chemicals have the potential to assist control of this pest, either by providing an effective monitoring tool for this pest, or by using them to remove female moths from the population.

**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, and consequent loss of seed yield. Knowledge of the hostplant chemicals that influence these pests could lead to the development of new methods for insect control.

**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: Breeding North Dakota Wheat For Resistance to Insect Pests**

Farmers growing wheat in North Dakota face many challenges, two of which are the wheat midge and Hessian fly. The 1995 wheat midge outbreak in northeastern and north-central North Dakota caused estimated revenue losses of \$30 million to wheat farmers. As well as being a pest and causing yield and quality losses to North Dakota farmers, the wheat midge may play a role in the spread of wheat scab (pers. Comm.. Bob Lamb, AgCanada). The Hessian fly appeared on the North Dakota wheat scene during the summer of 2003 when farmers in two areas, one northwest of Devil's Lake and one north of Minot, reported Hessian fly in both Hard Red Spring (HRS) and durum wheat fields.

For wheat midge, we made significant progress in collaboration with NDSU plant breeders and NDSU microscopy specialists towards the development of North Dakota spring and durum wheat with resistance to wheat midge. Major accomplishments were: 1) testing of spring and durum wheat genotypes in the greenhouse for the transfer of a resistance gene effective against the wheat midge, and 2) microscopy work to determine the method of feeding of the wheat midge and the mechanism whereby wheat carrying a major resistance gene inhibit feeding by the wheat midge.

For the Hessian fly, we finally succeeded (after trying for three years) to establish a colony of a North Dakota population of Hessian fly. Efforts were first made to collect Hessian fly pupae from a field north of Minot; however, populations were too small to collect a sufficient number of pupae. A second attempt was made in late August in Prosper, at the NDSU Research Farm where Dr. Mergoum had reported the presence of Hessian flies in his research plots. Insects from this collection emerged as adults in early September and have been cultured successfully since this time in our greenhouse and lab. These insects are being used to determine the frequency of virulence genes in this North Dakota population and to determine whether there is any resistance present in currently-grown ND HRS, white and durum wheats.

**Impact:** In the last decade, the wheat midge and Hessian fly have emerged as serious pests of durum and hard red spring wheat grown in North Dakota. Management practices including planting dates, scouting, and insecticide treatments, have mitigated the impact of these pests somewhat, but the best long-term solution is the introduction of insect-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 wheat midge, a cost that would be all but eliminated by the introduction of resistant varieties. For the Hessian fly, insecticides can again be used to kill the pest; however, by the time the pest is found in the crop, it is usually too late to reduce crop losses.

**Source of federal funds:** Hatch

**Scope of Impact:** Statewide research

### **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 and 2003, so overall loss due to FHB was much less, but individual fields in parts of the northeast district

of the state still had severe damage. Fungicide trials established in the affected regions have 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 \$17.50- \$31.50 per acre in 2003, 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. In 2003, the extension plant pathologist once again 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 900,000 acres of wheat and 160,000 acres of barley in ND in 2003. An average net return of \$25 per acre was realized, after cost of fungicides and indirect and direct costs were subtracted from the gross return/acre. This translates to a positive economic impact of \$22.5 million for wheat producers, and \$4 million for barley producers in 2003.

**Impact:** Producers utilized fungicides as a management strategy on 900,000 acres of wheat and 160,000 acres of barley realized an average return of \$25 per acre, resulting in an additional \$26.5 million revenue to producers who used this strategy in 2003. The Extension Specialist wrote the Specific Exemption for use of the fungicide, which was sent to the ND Dept. of Agriculture and subsequently approved by EPA. 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. North Dakota is also the largest producer of barley in the United States. 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. Surveys of sunflower fields for Sclerotinia and other diseases have been conducted in 2001, 2002, and 2003. Additional information on the field surveys and biology and management of Sclerotinia in sunflower and other susceptible crops was made available in 2001, 2002, and 2003 via training sessions and contributions to a CD-ROM provided to county and area Extension personnel 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 - of Weeds, Pathogens and Insect Pest**

Natural enemies of weeds, pathogens, and insect pests are a potentially-important component of Integrated Pest Management strategies. These biological control agents offer a mechanism to reduce the impact of weed, diseases, and insect pests without the use of expensive and potentially-dangerous chemical controls. 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, the causal agent of white mold, is a fungus that limits production capacity of many row crops including sunflower, dry beans, canola, and soybean. Several biological control agents of Sclerotinia were found in North Dakota soils, including species in the genera Trichoderma, Gliocladium, Coniothyrium, and Sporidesmium. "Intercept", a commercially-produced biological control agent of Sclerotinia, is being investigated for its efficacy of white mold control in the field. 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 - Genes**

The identification, characterization, and use of pest resistance genes in host plants are major goals for research programs on insect and disease problems of crop plants. 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) has caused over \$1 billion in combined small grains losses for producers in the Dakotas and Minnesota since 1993. Plant pathologists developed screening techniques for use in the greenhouse and in the field to test thousands of lines of small grains for resistance to the disease. Alsen, a FHB-resistant hard red spring wheat variety recently released by NDSU, was developed with this approach. Tens of thousands of acres have been planted to this variety in recent years. Other pathologists are working to identify potential new sources of resistance to problematic races of the leaf rust fungus now firmly established in the northern Great Plains. Future goals are to work with breeders to combine FHB and rust resistance into new cultivars. 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 use by the bean breeding program. Incorporating disease resistance genes into soybean cultivars has major impact on improving soybean production and profitability for growers. This is especially pertinent now because soybean is the most widely-grown row crop in North Dakota and Minnesota and because soybean cyst nematode, the most destructive disease of soybean, is now in both states. Extensive research in this area is now producing soybean cultivars with disease resistance.

**Impact:** Genetic resistance is the most efficient and safe way to control diseases and pests of crops. Genetic 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 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. This will help maintain consistent quality of soybean for food making and will help in marketing this valuable crop.

**Source of federal funds:** Hatch and NRI-CGP

**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, however it is typically not subjected to the same growth promoting hormones or antimicrobials that are often used in the cattle industry. Currently little is known of the microbiological safety of Bison meat. This study was carried out to evaluate the Bison slaughter process and gain a greater understanding of the types of foodborne pathogens that may be associated with this meat from these animals.

**Impact:** This is to the researcher's knowledge, one of the first studies of the microbiological quality of Bison meat. Data generated has been used to determine the safety of the slaughter process as well as gain a understanding of typical pathogens associated with this product. A database of information on foodborne pathogens on this emerging meat species has been created and further work is ongoing to characterize isolates recovered as well as determine how pathogens grow and behave on this meat species during storage. Ultimately, the research will lead to better strategies for ensuring the safety

of the Bison meat supply.

**Source of federal funds:** USDA CSREES NRI

**Scope of impact:** Multi-state research

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

Meat (beef) is an important food product. An intelligent system for spoilage characterization using a non-destructive technique was investigated. It was hypothesized that the autofluorescence signal of bacteria on the meat would increase as the meat is allowed to spoil over time. Our previous research has proved the potential of using the autofluorescence characteristics of edible beans for detecting cracks in them. The fluorescent images of meat (beef) were acquired using an intensified charged coupled device camera at 150 millisecond exposure time with a 440 nm cut-off filter. Two long wavelength UV lamps were used as the illumination source. The acquired images were processed for further analysis. A sequence of image processing operations including an automatic background segmentation were used to process the acquired images. Algorithms were used to extract histogram-based statistical features from the segmented meat images. It was found that with the increase in the number of storage days, the mean-pixel value of the histogram increased. This showed the underlying implication that, as the intensity of autofluorescence signal increased, the mean value of the gray level increased. This research shows the potential of using autofluorescence characteristics of meat as a possible non-destructive tool for assessing meat quality.

**Impact:** This research shows the potential of computer-based fluorescence imaging for quality characterization of meat (food) products. Once further validated and proved, this technique may be used for developing sensors or intelligent sensing systems for quality characterization of meat and similar food products.

**Source of federal funds:** Hatch

**Scope of Impact:** Multi-state research

**Key Theme:- Food Safety: Development of Intelligent Quality Sensors**

The long-term goal of our research projects is to develop miniaturized portable sensors that can provide quality information to users about specific food and agricultural products. We have three on-going projects. Our research project focuses on the development and evaluation of intelligent sensors (based on electronic nose technology) for evaluation of quality and safety of selected food products, spoilage of beef, contamination of beef (with Salmonella), mold growth in wheat and barley, quality of soymilk. We have adopted sensor-fusion concept to investigate the capability of infrared gas sensing mechanism for quality and safety characterization of the selected food products included in our study. For the proposed intelligent electronic sensors, we are following a modular approach for developing and/or evaluating different sensor/sensing modules. Each sensing module has its different sensing mechanism or characteristics. Research has been conducted to integrate and/or develop different sensing modules for characterizing head-space gas. Experiments have been

conducted to evaluate the performances of different sensing modules for spoilage characterization of meat (beef) packages under 10 and 3 degree C storage conditions. Concurrent microbiological analyses of the meat samples were conducted to determine the bacterial population in log<sub>10</sub> cfu/gram. Any meat sample with the bacteria population of 6 cfu/gm. was considered unspoiled. The meat samples with bacterial count of  $\geq 6$  cfu/gm. were considered spoiled. Techniques were developed to process the acquired signal from different sensing modules. Different statistical and artificial neural network-based models were developed for classifications of meat samples into one of the two groups, i.e. spoiled or unspoiled. The obtained results show promise. The maximum overall classification accuracy among different sensing module is 100 percent. The obtained classification accuracies have shown variation among sensing modules and among the meat samples tested on different days. Additional testes will further validate the results.

**Impact:** Miniaturized sensors can help provide consumers with safe and high quality food products. The proposed intelligent sensors, based on electronic nose technology, show promise. The proposed sensors could alert consumers of possible safety risk before the food is consumed.

**Source of federal funds:** USDA-CSREES-Special Grant

**Scope of Impact:** Multi-state Research

**Key Theme - Food Quality: North Dakota Beef Quality Assurance**

Beef Quality Assurance (BQA) training sessions have been held throughout North Dakota in 1999, 2000, 2001, 2002 and, 2003. The goal of the program is to improve the quality, safety and consistency of beef, resulting in a more consumer acceptable product. A recertification program has been developed to allow producer to become recertified using a variety of methods, including attending a BQA training session and getting recertified over the Internet.

**Impact:** As a result of these training sessions, 1,700 operations have been certified, and more than 2,500 cattle producers educated in beef quality assurance practices. These operations produce more than 260,000 head annually, 26 percent of the state's calves. Comparison of pre- and post-tests taken by participants at each session found an average improvement of 15 percent in test scores. Producers and marketing organizations report a heightened interest in North Dakota BQA certified cattle by alliance programs such as Nebraska Corn Fed Beef. These groups have also reported some increased prices for calves certified in the North Dakota BQA Program. To improve the visibility of BQA certified feeder cattle, a "Feeder Fax" website was developed in 2002. This site allows producers to list their feeder calves for sale. Included in the listing is number of cattle, sex, approximate weight, breed composition, past production and carcass data, prevention animal health program, and date and location of sale. The number of cattle listed on this site has increased over the past year.

As a result of the BQA training program, both county extension agents and veterinarians report a change in producer's behavior in how they administer injections and in their record keeping practices. They report producers are moving their injection site from the hind quarters to the neck, and are keeping more detailed animal health, husbandry, and production records.

**Source of federal funds:** Smith-Lever

**Scope of impact:** Statewide extension.

<u>Allocated Resources</u> (\$ x \$1,000)		<b>FY03</b>
1862 Extension (\$)	Smith-Lever	1,148
	State	1,722
	FTE	41
1862 Research (\$)	Hatch	646
	State	950
	FTE	19

### **Goal 3: A Healthy, Well-Nourished Population**

***Overview.** Risk for several chronic diseases such as heart disease, cancer, type 2 diabetes, and osteoporosis are related to diet and physical activity. It has been estimated that these health conditions cost society over \$200 billion a year in medical expenses and lost productivity. There is strong evidence supporting the health benefits of a healthy lifestyle: consumption of a varied diet with less total and saturated fat; less processed carbohydrates; more fruits, vegetables, and whole grain products which contribute dietary fiber and a variety of vitamins, minerals, and phyto-chemicals; greater inclusion of lower-fat dairy products including fluid milk; and regular, moderate physical activity. However Americans, including North Dakotans, are not meeting national nutrition and health goals.*

*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. The prevalence rate of diabetes is 6.1 percent of the total adult population of North Dakota rising to greater than 14 percent in the 65 to 74 year old population. Diabetes is on the rise in North Dakota from 3.6 percent of the population in 1994 to 6.1 percent in 2002. National data from the Indian Health Service for 2000 indicates that about 15 percent of the American Indians and Alaska Natives have diabetes which is similar to the prevalence rate of diabetes (15.1 percent) among Native Americans in North Dakota.*

*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 2002-2003, 14 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.*

*In an information campaign directed toward women statewide, awareness of folic acid has significantly increased. A statewide task force has implemented the campaign statewide. According to the most recent national Gallup Survey, of the total population, 63 percent of North Dakota adults were aware of folic acid compared to 60 percent of U.S. adults nationally. Among women ages 18-44, 80 percent were aware of folic acid compared to 70 percent of U.S. adults nationally.*

*The first of a series of lessons based on promoting the health attributes of foods produced in the Dakotas has been developed. The first lesson is entitled "Flaxseed: Agriculture to Health" and is being widely utilized across the state in the current year. Pre- and post-lesson evaluations are being conducted. The lesson series will include the following: (1)North Dakota Oils: Agriculture to Health; (2)Whole grains: Agriculture to Health; and (3)Beans: Agriculture to Health. Funding has been located to distribute the educational materials which have been developed about the health benefits of flaxseed to dietitians nationally who are interested in complementary medicine.*

*The 4th annual Women's Overall Wellness Retreat occurred at the Assumption Abbey in Richardton, N.D. during September 2003 as a collaborative effort between NDSU Extension and the West River Medical Center in Hettinger, N.D. The goal of the annual retreat is to empower women to take leadership roles for women's health issues both for themselves and their rural communities. Participants indicated interest in health education in the following areas: chronic diseases such as heart disease, hypertension, cancer, diabetes, as well as life stage issues such as menopause.*

*Self-rating based on the "Stages of Change" model indicated that sleep patterns, eating patterns (regular intervals), and regular exercise patterns would be areas to focus education for increased consistency of these health habits.*

### **Key Theme - Human Health: Fruit and Vegetable Consumption and Inactivity**

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 billion. 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:** Fourteen community-based groups across North Dakota 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.

In the past three years, 850 youth have participated in a program titled "On The Move." Knowledge of recommended daily amounts of fruits and vegetables ("5 A Day") increased from 35 percent (pre-survey) to 83 percent (post-survey). Self-reported consumption of five servings of fruits and vegetables increased from 13 percent (pre-survey) to 32 percent (post-survey). Self-reported daily physical activity increased from 69 percent (pre-survey) to 80 percent (post-survey). Surveys also indicated that soda pop consumption and TV viewing have decreased. Follow-up surveys have shown that after five months most of the increase in fruit and vegetable consumption have been sustained.

**Scope of impact:** Statewide extension

**Source of federal funds:** Smith-Lever

### **Key Theme - Human Health: Youth Obesity and Inactivity**

Childhood overweight/obesity often persists in adulthood and can set the stage for many health issues. Regular physical activity and healthy eating can help prevent obesity and chronic illness, but children are not consistently meeting current recommendations. Physical activity classes in schools have been cut in many locations, which contributes to sedentary lifestyles. Time spent on computers and video games also increases sedentary behavior.

About 60 high school students from the N.D. Governor's School, an on-campus six-week program that provides advanced science, math and leadership training for junior-level students from across the state, participated. The objectives of the "Stepping Up Physical Activity" program were to increase knowledge of the benefits of regular moderate physical activity among a target group of

high school students, to increase or maintain physical activity at 10,000 or more steps daily as monitored by pedometers and to involve youth in the assessment process to potentially influence school policy through youth/adult partnerships.

Students monitored and recorded their daily physical activity level with pedometers. Classroom instruction and hands-on activities were used to increase students' knowledge of nutrition and physical activity. According to group discussions and an on-line survey about nutrition and physical activity, students recommended longer school lunch breaks to allow time to engage in physical activity and organized, supervised individual fitness programs in schools in addition to team sports. About 56 percent reported no physical education classes for their age group. All students received a packet of materials to help conduct health-promotion activities in their schools.

**Impact:** About 43 percent of the females and 44 percent of the males increased their number of daily steps as measured by pedometers. About 77 percent of females and 78 percent of males indicated they would continue to wear their pedometers "most of the time" or "sometimes." About 70 percent of females and 78 percent of males regularly met the goal of 10,000 steps daily.

**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 18-24-year-old women across North Dakota with folic acid education based on the CDC's "Ready or Not" national campaign. Collaborators included extension agents, public health nutritionists, college wellness coordinators, nurses, pharmacists, and dietetics students from two campuses. The multi-faceted campaign used radio, newspaper ads, bathroom stall ads, radio interviews, newspaper columns, brochures, auxiliary labels on prescriptions 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.

**Impact:** Impact was evaluated in several ways: locally, statewide and nationally. Survey results collected by task force members from 680 participants in educational displays at health fairs, bridal shows and other events were as follows:

- 91 percent knew that folic acid can help prevent birth defects.
- 80 percent identified leafy green vegetables and multivitamins as good sources of folate/folic acid.
- 70 percent of the survey participants recognized that folic acid is a vitamin.
- 67.5 percent were able to identify the daily recommendation for folic acid (400 micrograms)
- 65 percent knew that half of pregnancies are unplanned.

The results related to folic acid awareness collected from North Dakota's Behavioral Risk Surveillance Survey also were evaluated. For example, in 2002 about 63.7 percent of females 25 to 34 knew the link between folic acid and birth defects, compared to 47.4 percent of the same age group in 2001. Among all adults, about 52 percent were aware of the connection. In 2002, 59.3 percent of females 25-34 reported taking a multivitamin compared to 46.5 percent of the same age group in 2001. Regarding folic acid, just 27.3 percent of females 25-34 indicated their supplements contained folic acid in 2001, compared to 81.2 percent in 2002. This discrepancy probably indicates a much greater awareness of folic acid in supplements in 2002. Although the sample size was small, all the females ages 25-34 reported taking the folic-acid containing supplement daily in 2002.

A nationwide Gallup Organization random telephone survey with 20,903 adult participants, including 400 in North Dakota, was conducted by the March of Dimes. The results were as follows:

- Awareness of folic acid was higher in North Dakota than nationally. For example, of the total population, 63 percent of North Dakota adults were aware of folic acid compared to 60 percent of U.S. adults nationally. Among women ages 18-44, 80 percent were aware of folic acid compared to 70 percent of U.S. adults nationally.
- About 23 percent of North Dakota respondents reported taking a vitamin supplement containing folic acid or a folic acid supplement daily compared to 24 percent nationally.

**Source of federal funds:** Smith-Lever

**Scope of impact:** Statewide 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 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 satisfy 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 88 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 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 51 percent of homemakers showed improvement in one or more of the food safety practices such as thawing and storing foods properly. Also, 62 percent of participants at entry into the EFNEP program demonstrated acceptable food safety practices. At the end of the program, 82 percent of the 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 80 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. Also, 25 percent of the participants at entry level demonstrated acceptable practices of food resource management, compared to 58 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 Health: Childhood Obesity**

Data from North Dakota high school students (YRBSS 2001) indicated that 12.2 percent were at risk of becoming overweight, 9.2 percent were overweight, 31.9 percent thought they were overweight,

47.5 percent were trying to lose weight. For 2003 in North Dakota, 82.7 percent of high school students reported eating fewer than 5 servings of fruits and vegetables and 73.9 percent reported less than 3 glasses of milk per day. Fifty percent of high school students reported drinking more than 12 ounces of sweetened beverage per day. Almost two-thirds (62.8 percent) of North Dakota high school students in 2003 reported not taking a daily physical education class. More than half (57.3 percent) reported watching television or playing video games for more than 2 hours per day. About one third (37.2 percent) of North Dakota high school students reported not meeting the criteria for a sufficient amount of physical activity (either vigorous or moderate). Vigorous physical activity was defined as activity making you sweat or breathe hard for more than 20 minutes on 3 of the 7 days preceding the survey. Moderate physical activity was defined activity that did not make them sweat or breathe hard for more than 30 minutes on more than 5 of the 7 days preceding the survey. New guidelines indicate children need at least 60 minutes of physical activity per day, spaced throughout the day and recommendations discourage extended periods of inactivity during the day (no longer than 2 hours).

**Impact:** A community coalition was initiated in Walsh County during the summer of 2003. It is called Positive Lifestyles for Active Youth (P.L.A.Y.) Partnership. It has a broad base of membership including education (public school administrators and teachers; Head Start; after-school programs), the Health Department, WIC, nurses and other health professionals, parks and recreation, parents, as well as Extension (both regular programming and those for food stamp recipients) and others. To develop their goals they are doing community and health assessment as well as looking for available sources of funding. Additional plans by the state office include promotion of the development of additional coalitions by hosting meetings in interested communities /counties during spring 2004. A web site has been developed as a resource for community coalitions and health and education professionals in North Dakota (<http://www.ext.nodak.edu/food/healthyweight/>)

**Scope of impact:** Statewide Extension

**Source of federal funds:** Smith-Lever

### **Key Theme – Human Health: Agriculture to Health ( Dakota Diet )**

The Dakota Diet concept suggests that foods produced in the Dakotas and Northern Plains, when incorporated into the framework of the Food Guide Pyramid, will promote health and reduce chronic disease. The food systems approach considers the agriculture to health issues from agricultural production, processing, packaging, marketing, purchasing, preparation, and consumption. Some crops produced on the Northern Plains are known to contain nutrients or phyto-chemicals that may reduce the risk of chronic disease. For example, the omega 3 fatty acids and lignan in flaxseed have been demonstrated to provide certain health benefits such as the following: helps reduce the risk of heart disease; provides anti-inflammatory effects which may benefit auto-immune diseases such as rheumatoid arthritis; provides relief from some menopausal symptoms; etc. A number of healthy plant oils such as canola, flax, soybean, sunflower, and others are produced in this area. The Northern Plains are major producers of legumes such as beans, peas, and lentils which have many health promoting qualities. The selenium content of the soil is high in some areas of the Northern Plains which is reflected in the mineral content of foods grown in those areas. Higher selenium

intake has been related to the reduced risk of certain cancers.

**Impact:** The first of a series of lessons based on promoting the health attributes of foods produced in the Dakotas has been developed. The first lesson is entitled "Flaxseed: Agriculture to Health" and is being widely utilized across the state in the current year. Pre- and post-lesson evaluations are being conducted. The lesson series will include the following: (1)North Dakota Oils: Agriculture to Health; (2)Whole grains: Agriculture to Health; and (3)Beans: Agriculture to Health. Funding has been located to distribute the educational materials which have been developed about the health benefits of flaxseed to dietitians nationally who are interested in complementary medicine.

**Scope of impact:** Statewide Extension

**Source of federal funds:** Smith Lever

### **Key Theme – Human Health: Women's Health**

One in 10 women in the United States ages 45 to 64 years of age has some form of heart disease. For women over 65 years of age, one in four have some form of heart disease. Heart disease is the number one killer of women in North Dakota. Each year, North Dakota loses an average of 1,113 women to heart disease and stroke. The risk factors for heart disease include cigarette smoking, high blood pressure, high blood cholesterol, overweight, physical inactivity, and having diabetes. Adults with diabetes have death rates from heart disease that are two to four times higher than for the general population. The rate of heart disease is two to three times higher for postmenopausal women compared to those who are pre-menopausal. The risk of heart disease and stroke can be greatly reduced by lifestyle changes including modification of dietary intake and increased physical activity.

**Impact:** The 4th annual Women's Overall Wellness Retreat occurred at the Assumption Abbey in Richardton, N.D. during September 2003 as a collaborative effort between NDSU Extension and the West River Medical Center in Hettinger, N.D. The goal of the annual retreat is to empower women to take leadership roles for women's health issues both for themselves and their rural communities. Thirty-two out of 45 participants completed the computer based evaluation of the retreat. Results from the evaluation indicated interest in health education in the following areas: chronic diseases such as heart disease, hypertension, cancer, diabetes, as well as life stage issues such as menopause. Self-rating based on the "Stages of Change" model indicated that sleep patterns, eating patterns (regular intervals), and regular exercise patterns would be areas to focus education for increased consistency of these health habits.

Respondents indicated an interest in information on time management skills for healthy lifestyle behaviors. Most favored delivery of additional information on healthy lifestyles by newsletters, direct mailing, or news articles.

**Scope of impact:** Statewide Extension

**Source of federal funds:** Smith-Lever

Allocated Resources  
(\$ x \$1,000)

**FY03**

1862 Extension (\$)	Smith-Lever	910
	State	1,365
	FTE	32.5
1862 Research (\$)	Hatch	0
	State	0
	FTE	0

## **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.*

*Extension programs on site-specific management reached thousands of producers in the region. 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.*

*The NDSU Soil Testing Laboratory processed 17,852 soil samples for farmers, agricultural 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.*

*Before NDSU launched research and extension programs on controlling leafy spurge, the number of acres infested with the weed was doubling every decade. If left unchecked, the current infestation would be about 3.8 million acres in North Dakota alone. However, since the introduction of this program, the present infestation is about 1.2 million acres which has held steady or declined in the*

*last eight years. Herbicide treatments incorporated with the *Aphthona* spp. biocontrol agents have provided much better long-term control than either method used alone. Grazing with sheep or goats followed by a fall herbicide treatment has resulted in greater forage utilization by sheep, goats, and cattle and reduced the leafy spurge infestation to near zero. Combinations of herbicides with different modes of action have provided long-term reduction of leafy spurge with less input costs and less pesticide in the environment. Competitive grass and forb species have been introduced to replace leafy spurge once the weed was controlled.*

*Twenty-eight county agents/educators and Natural Resource Conservation Service staff participated in two three-day sustainable agricultural programs. These programs educated the professionals on range management, livestock nutritional needs, range habitat assessment, and mentor development. By teaching the sustainable range management to professionals that are the key contact personnel in a county, we can provide educational tools and materials to potentially thousands of land managers impacting hundreds of thousand acres in North and South Dakota.*

### **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 are being combined to evaluate the effectiveness of their individual relationship with residual soil nitrate patterns and their synergy. Sugarbeet growers in the Red River Valley use satellite imagery and aerial photography to map 150,000 areas of sugarbeet fields and then give an N credit or adjustment for subsequent crops based on relative canopy N content. 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 2003, programs focusing on site-specific management totaled about 500 attendees at various presentations around North Dakota. In addition, site-specific soil testing has been woven into nearly all presentations given, amounting to about 2,500 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 (\$9-\$15/acre current price). Comparison of site-specific N management with an adjacent grower field, showed 60 lb N per acre less leaching on the site-specifically managed corn compared to a conventionally managed 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 to 2002, the NDSU Soil Testing Laboratory processed 17,852 soil samples for farmers, agricultural consultants and researchers from North Dakota and Minnesota.

**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. We are currently developing correlations with crop production and soil test results for two crops: canola for central ND and barley in the far western part of the state.

**Source of funding:** Hatch

**Scope of impact:** Multistate research and extension, ND, MN, MT and SD

**Key Theme - Water Quality: Irrigation Technical Information and Assistance**

Effective irrigation water management requires accurate daily crop water use estimates. Since 1995, the NDSU Extension Service 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 67 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.

Since 1977, extension has had a bulletin on irrigation scheduling by the Checkbook method. This bulletin has been very popular with growers. In 2000 a computerized version of the checkbook was developed in cooperation with the Minnesota Extension Service. The program was revised in 2001 and has been distributed throughout both states. In 2003, a version of the checkbook program was developed that would run on a Palm Pilot.

**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 2003 growing season, the crop water use Web site handled over 50,000 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 850 distinct computers accessed the Web site. The crop water use numerical tables were requested about ten 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 working 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.

Every year since 1977, between 500 and 800 of the Irrigation Scheduling by the Checkbook Method (AE-792) bulletins have been distributed. Over the years, this bulletin has been copied by the extension services of other states. Since development of the computerized version, more than 100 copies have been distributed in North Dakota and Minnesota.

**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:** Development of irrigation, N fertility, variety selection recommendations for wheat can help producers maximize profitability. The potato planting configuration research shows promise for significant yield improvements and water conservation in drought-sensitive situations. It is expected that the inter-row water harvesting effect that is being studied will be applicable to other crops.

**Source of federal funds:** Hatch

**Scope of impact:** Statewide research

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

NDSU researchers have evaluated appraisal procedures of the Small Wetland Easement Acquisition Program of the United States Fish and Wildlife Service (USFW) in the Prairie Pothole States of North Dakota, Minnesota and South Dakota.

**Impact:** Estimates of average values for land surrounding USFWS wetland easements were much higher when published county-level land value data was used in place of comparable sales-based appraisals: by 11 percent in North Dakota and South Dakota, and by 22 percent in Minnesota. The differences were smallest for tracts dominated by cropland rather than pastureland in North Dakota but the reverse was true in South Dakota. Using county land value data as a basis for easement payment offers would have increased overall expenditures for the Fish and Wildlife Service Small Wetland Acquisition Program by 9 percent in North Dakota, 11 percent in South Dakota, and 22 percent in Minnesota. These increases would have been at least partially offset by associated reductions in the costs of making site-specific appraisals.

**Source of federal funds:** Hatch

**Scope of impact:** Multi-state research: ND, SD, MN.

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

The statewide IPM crop and pest survey has evolved into a more comprehensive program for obtaining crop and pest information. Beginning in 2002, the survey was expanded to include five crops and their key pests. In 2003, the state was divided into five regions. Six crops and their key pests were surveyed from the last week of May until the end of August. A total of 2508 fields were

visited. Information from these surveys is summarized in geo-referenced maps and used in newsletters, reports, and web information. The survey can be found at: <http://www.ag.ndsu.nodak.edu/aginfo/ndipm/>. The maps summarizing the sampling data were used to graphically illustrate where pest problems were developing in the region. Crops include wheat, barley, soybean, flax, sunflower, and canola. Pests include grasshoppers, cereal aphids, cereal leaf rust, *Fusarium* head blight, soybean aphid, flea beetles, white mold/sclerotinia, and many, many more that are specific to the crops. This survey program has evolved during the past four seasons, incorporating the geo-referencing of data, mapping, to expansive of crops and focus of pest issues.

Regional surveys for detection of overwintering larvae of the Orange Wheat Blossom Midge have been conducted for eight years. These surveys identify locations of high populations of overwintering midge and are used by growers and managers to help plan for the up coming season. The project has been funded through the North Dakota Wheat Commission since 1995. Members of the commission continue to support the effort and have expressed a desire to continue funding the project. Funds were reduced for the 2002 and 2003 surveys, resulting in fewer counties being included in the project. Counties surveyed were only in the northern half of the state, where midge risk is greatest.

North Dakota is currently part of the North Central Pest Management Center. Projects involving pest management strategic plans (PMSP) included a regional pea and lentil plan, and a wheat PMSP for ND, SD, and Nebraska. In addition, a pesticide use survey was implemented for alfalfa production in ND, SD, NE, and KS. Other PMSP's that ND has participated include potato, field and sweet corn, and soybean.

**Impact:** The crop and pest survey has provided valuable information about current crop and pest situations as they develop in the region. With the survey information, extension specialists have been able to develop programming needs to address the issues that were being faced by agriculture in a proactive fashion rather than after the fact. The proactive programming provides the tools to make timely management decisions that produce economic return during the current production season.

**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 - Integrated Pest Management: Invasive Weeds**

Invasive weeds are one of the greatest threats to croplands, rangelands, and wildlands, not only in the region, but in the United States. Leafy spurge alone currently infests more than 4 million acres in the Northern Great Plains and Intermountain West and causes an estimated \$195 million annual loss due to decreases in forage and livestock production, wildland- and wildlife-associated recreation, and soil and water conservation. Leafy spurge can be successfully controlled with herbicides; however, treating leafy spurge with herbicides is not always cost-effective. In fact, approximately 40 percent of the leafy spurge infested-rangeland has a carrying capacity value below the herbicide cost break-even point. Biological control is an economic alternative to herbicides in managing leafy spurge on rangeland habitats. To date, 15 species of insects have been released in North Dakota for control of leafy spurge, and the *Aphthona* spp. flea beetles have become the most successful. Leafy spurge control with flea beetles has ranged from zero to over 95 percent stem reduction with approximately 30 percent of the releases considered successful. Other tools developed for leafy spurge control include grazing by sheep or goats and planting competitive species. Multiple approaches are needed since no single method will control leafy spurge in all the environments in which the plant is found.

**Impact:** Prior to this program, leafy spurge was doubling in acreage every 10 years. If left unchecked, the current infestation would be about 3.8 million acres in North Dakota alone. However, since the introduction of this program, the present infestation is about 1.2 million acres which has held steady or declined in the last 8 years. This integrated research and teaching program included personnel from several federal agencies, five states, and many counties in the region. A variety of integrated methods was developed to control and reduce leafy spurge and the resulting technology was brought to the public in a variety of methods including meetings, publications, and electronic media. Herbicide treatments incorporated with the *Aphthona* spp. biocontrol agents have provided much better long-term control than either method used alone. Grazing with sheep or goats followed by a fall herbicide treatment has resulted in greater forage utilization by sheep, goats, and cattle and reduced the leafy spurge infestation to near zero. Combinations of herbicides with different modes of action have provided long-term reduction of leafy spurge with less input costs and less pesticide in the environment. Competitive grass and forb species have been introduced to replace leafy spurge once the weed was controlled. The incorporation of herbicide treatment with biological control agents has successfully controlled leafy spurge in the habitat of the western prairie fringed orchid, an endangered species, without harming the orchid. This was the first time an herbicide was allowed to be used over an endangered plant species. Leafy spurge is no longer the

most feared noxious weed in the region because land managers now have a variety of effective tools available to control the weed.

**Source of federal funds:** Smith-Lever and Hatch, federal grants

**Scope of impact:** Multi-state in the North Central and Rocky Mountain Regions

**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

- Development and publication of one book, "Rancher's Guide to Grassland Management" and developed the second edition to the book, "Rancher's Guide to Grassland Management 2" due out in March 2004. Book encompasses 23 chapters including sections on plant identification, noxious weed identification and control, poisonous plants, grazing management, forage and pasture development, and much more.
- Cow/calf and 12-month grazing and forage planning workshop (two- and three-day): Three intensive grazing, forage and livestock management sessions were held in Ellendale, Killdeer, and Dickinson 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 and/or natural resource workshops were conducted at 34 locations in North Dakota, including 4 via the polycom video system. 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 one to two-day natural resource management programs on tribal lands in North and South Dakota: These programs 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. Twenty-eight 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:** The first edition of "Rancher's Guide to Grassland Management" was published in January 2003 and out of print by March, with more than 400 copies distributed to eastern North Dakota and

western Minnesota farmers and ranchers and natural resource professionals. Sixty-four ranchers participated in the cow/calf and 12-month forage planning workshops. These three workshops impacted 73,450 acres of native rangeland, pastureland, and hayland and 6,091 cattle. More than 80 to 85 percent of the participants were planning to add new range improvement practices or cattle nutritional programs.

One-day range and forage management workshops and schools were conducted for 1,070 participants in North Dakota, bordering counties of South Dakota and Montana, Wyoming, and Manitoba, Canada. These programs were designed to introduce and teach ranchers, farmers, land managers, and youth the 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.

Thirty youth ages 13-18 participated in the four-day range camp and 112 participated in the State Range Judging Contest. Six other educational programs were taught to youth ages 10 through 18 and undergraduate college students, totaling 167 students. 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.

Thirty-two and 35 people participated in the two natural resource educational programs associated with tribal lands on Fort Berthold and Standing Rock reservations in North Dakota and Pine Ridge Reservation in South Dakota. On average, 24 professionals who work on the reservation, five ranchers/farmers, and four students and tribal elders participated in these programs. These 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 from previous needs assessments indicate a need for natural resource educational material and programs to enhance use for small and mid-size ranchers and farmers. There is also a need to be more sustainable on the Tribal lands and to use commodity products within the Tribal areas more effectively. A better understanding and marketability of bison and the natural resources will be addressed as well.

Twenty-eight 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. By teaching the sustainable range management to professionals that are the key contact personnel in a county, we can provide educational tools and materials to potentially thousands of land managers impacting hundreds of thousand acres in North and South Dakota. This program was a 2-year project that finished in 2003. An advanced level program will be offered in 2004 and 2005 through the NCC SARE program.

#### Research

- 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.

- 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 of dormant season prescribed fall fire on herbage production and plant community dynamics of native rangeland managed using seasonlong or twice-over rotation grazing and nonuse in western North Dakota: NDSU Extension Service, in cooperation with the Animal and Range Sciences Department and USDA Forest Service has conducted this trial in western rangelands of North Dakota.

**Impacts:** 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 98 percent and 96 percent on single-species and multi-species grazing treatments, respectively, after eight 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 eight 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.

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 15 to 26 percent. These results are from years 1, 2 and 3 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.

Nine months post prescribed October dormant season fire decreased herbage production on the seasonlong grazing treatment; however, no significant reductions occurred on the twice-over rotation grazing system or nonuse treatment. Almost a 100 percent kill of club moss occurred from the prescribed fire, irrelevant of treatment.

**Source of federal funds:** Hatch and Smith-Lever

**Scope of Impact:** Multi-state research and extension

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

The Livestock Environmental Stewardship workshop was held for NRCS personnel, engineers, NDSU Extension Agents, Watershed coordinators, and individuals interested in livestock and environmental stewardship. Over the two-day workshop, several topics were covered including Principles of Environmental Stewardship, Whole Farm Nutrient Management Planning, Animal Dietary Strategies to Reduce Nutrient Excretion, Manure Storage and Treatment, Composting

Practices, Land Application and Nutrient Management, Outdoor Air Quality, Odor Management, and Comprehensive Nutrient Management Plans. There were thirty-seven individuals in attendance. The Livestock and Poultry Environmental Stewardship Curriculum was the basis of information delivered at the workshop with supplemental materials coming from the NDSU Extension Service and NRCS. Each individual was given a three-ring binder with the curriculum, a CD which contained all the PowerPoint presentations and copies of CAFO Facts sheets.

Nutrient Management issues were presented at several meetings across the state. Locations included Jamestown, Hettinger, Carrington, Lisbon, Fargo, Hazen and Rapid City, SD. Over 100 individuals were reached at these meetings. Audiences included producers, NRCS, SCD, NDSU Extension, SDSU Extension, MSU Extension, University of Wyoming Extension personnel and research personnel. The objective of each presentation varied slightly, but all presentations included a general discussion of the principles of nutrient management and regulation for animal feeding operations.

**Impact:** At the Livestock Environmental Stewardship Workshops, twenty-eight of the thirty-seven attendees completed an evaluation form. Twenty-five of the attendees felt the presented material was adequate with the exception of information on regulations for the state of North Dakota. No evaluations were completed for the Nutrient Management sessions held throughout the North and South Dakota.

**Source of federal funds:** Smith-Lever and EPA

**Scope of impact:** State specific

<u>Allocated Resources</u> (\$ x \$1,000)		<b>FYO3</b>
1862 Extension (\$)	Smith-Lever	350
	State	525
	FTE	12.5
1862 Research (\$)	Hatch	289
	State	425
	FTE	8.5

## **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*

*factors 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 to 1992, 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.*

### **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.

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 of 2001. A survey conducted after three months indicated that of the fifteen action items that were identified in four major issue areas, only six items had no action while three had already had substantial progress or 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 2003.

**Source of Federal Funds:** Smith-Lever and CSREES Fed. Admin.

**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. Eighty-two communities are currently in the process or have concluded conducting strategic planning programs with the assistance of the trained facilitators. An additional fifteen communities were identified and participated as three member teams in a Heartland Center training sponsored by Federal Land Bank. If you calculated the total of volunteer time dedicated to the strategic planning process in the eighty- two communities by taking an average of 15 hours per steering committee member times 12 or the average size of a committee times \$14.83 (value of one hour of volunteer time) times 82 communities you would get \$2,320,242 total value of volunteer time spent on strategic planning in ND communities.

**Source of Federal Funds:** Smith-Lever and CSREES Fed. Admin.

**Scope of Impact:** State Specific

**Key Theme - Supplemental Income Strategies: Rural Economic Development**

Extension specialists and county extension agents conducted educational Agritainment workshops in 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, 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 that they would make changes in their current operation due to what was learned. Samples of businesses started as a direct result of attending the workshops include a pumpkin and corn maze business, lake cabins and fishing guide, bed and breakfasts plus numerous business owners have contributed increased success of their business to what was learned in the workshop.

The extension service and partners were instrumental in the organizational phase of establishing a state tourism association for rural and nature based tourism businesses and organizations. The organization should be formalized in 2004.

**Source of Federal Funds:** Smith-Lever and CSREES Fed. Admin.

**Scope of Impact:** Multi-state Extension - ND and MT

**Key Theme - Promoting Business Programs: E-Commerce for Small Business**

The information technology revolution holds the promise of reducing the disadvantages of distance and low population density that have long held back rural communities relative to their urban counterparts. Survival of rural enterprises and communities depends greatly on how rural people are prepared to deal the Information Technology revolution, where services are available 24 hours a day, 7 days a week. Rural residents must develop the necessary skills for employability of entrepreneurship in an evolving industry. They also need the skills to market their products in a competitive area.

**Impact:** Five classes were offered last fall in Fessenden, Hettinger, Watford City, Devils Lake and Langdon. The hands-on, computer-based workshop was offered as a one-day workshop from 9 - 5 instead of as a multi-date program as has been done elsewhere. A total of 33 individuals have taken the course in the 5 sites and have provided very positive initial feedback. The course is designed to assist people in determining their need for a web presence and the vast majority of participants reported plans to either start a website, begin to participate in online auctions, or participate in other portal-type sites to market and sell their product. A six-month follow-up survey will be done in March and April for all participants that had taken the course in the fall of 2003.

**Source of Federal Funds:** Smith Lever and Dept. of Commerce

**Scope of Impact:** State

**Key Theme – Impact of Change on Rural Communities: The socioeconomic impacts of the Conservation Reserve Program (CRP)**

Changes in the use of natural resources can result in major impacts on rural communities. This study examined the impacts of the CRP on rural communities of North Dakota. Study communities were in six different regions of the state, all characterized by high participation in the CRP. Study communities ranged in size from 200 to 16,000 residents.

**Impact:** The study identified several ways in which the CRP program could be modified to lessen adverse community impacts, or increase local benefits. These included:

- Managed haying and/or grazing of CRP land, which could not only provide a feed base for the local livestock industry but also improve the land's wildlife habitat value.

- Adjust eligibility criteria to emphasize highly erodible land and prevent enrollment of productive farmland.
- Increase recreational access to CRP land, through incentive programs for landowners.

The managed haying and/or grazing recommendation was implemented in the new Farm Bill while the access issue is addressed by legislation (“Open Fields Initiative”– Sen. Conrad) currently pending in Congress.

**Source of Federal Funds:** Hatch

**Scope of Impact:** National

**Key Theme - Impact of Change on Rural Communities: The Economic Effects of Migration**

This study explored the economic consequences of out-migration by examining data from the Internal Revenue Service (IRS) migration flow files. These files contain statistics derived from individual tax forms filed with the IRS and are based on year-to-year changes in the addresses reported by tax filers. The IRS does not release any micro-data on individual tax filers but aggregates the total number of filers who move between each pair of counties in the country. These files allowed us to calculate the net exchange in taxable income between movers to-and- from North Dakota over time.

The analysis reveals that between 1998-99 and 2000-01, more wage earners moved out-of-state than moved into North Dakota. This resulted in a net loss of taxable income to the state of \$384.5 million. A comparison of the median taxable income between tax filers moving into the state and those leaving the state shows that residents leaving rural counties, on average, have lower incomes than those moving into rural North Dakota. In 72 percent of the state’s rural counties (28 of 39), the median income of the newly arriving tax filers was higher than those leaving between 2000 and 2001. This situation was reversed in the state’s urban counties. In 9 of the 14 urban counties, tax filers leaving had higher incomes than those arriving between 2000 and 2001.

**Impact:** Quantifying the economic cost of migration helps regional economic development staff place into perspective the consequence of rural decline and the need find solutions to the depopulation crisis in rural areas.

**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. Understanding these trends and providing unbiased information to assist

consumers in making these decisions requires continuous development and dissemination of research and fact-based educational materials and delivery formats. Such information has been historically sought from land-grant institutions, such as North Dakota State University.

Extension specialists, faculty and extension agents are instrumental in providing this resource to citizens of the state. 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 collaborate 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 a information-rich society.

**Impact:** Through these programs and relationships, North Dakota consumers will understand their rights and responsibilities as consumers. Collaborative relationships with other consumer education organizations will be strengthened and consumers will improve their decision-making skills. While all consumers in the state of North Dakota will benefit from the consumer management program, certain audiences will be targeted, such as limited resource audiences, prone to predatory lending practices. In addition, the elderly population is growing in the state and special efforts will be made to provide sound information for their needs, and for the people who work with, and care for them.

**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 need to prepare for financial security in later life. The national CSREES 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 that 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 user friendly format.

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

- engage in activities which increase their financial literacy related to later life issues
- utilize 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.

**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

While the program will provide useful information for all individuals and families, various programs

and activities will have targeted audiences. For example, the High School Financial Planning Program will target high school students and educators, and the Becoming Money Wise will target limited resource audiences.

**Source of Federal Funds:** Smith-Lever

**Scope of Impact:** Statewide extension

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

Youth in North Dakota need opportunities to explore career possibilities, to view education as a tool to success, and learn the attitudes, skills, and work habits valued by employers and needed by entrepreneurs. Youth need to know what to expect in the workplace.

Science and technology affect the career opportunities for youth. Science and technology education will affect decisions relating to future education and careers. The 4-H program can supplement and enhance science and technology education now offered in schools for youth and adults.

Awareness of career possibilities opens doors to further education, gives focus to activities and educational settings and stimulates organization and planning for further education.

The determination to complete a project started, the ability to plan and organize, the respect for others shown when a young person informs a leader or volunteer they can or cannot complete a project or activity at the agreed upon time are all characteristics that will help the individual in the world of work. Subject matter may prepare a person for a particular job, but the real successful employees have the skills to follow through on commitment, and have the ability to communicate and get along with others.

**Impact:** Nearly 150 youth participating in Extension Youth Conference were exposed to a variety of fields of study at North Dakota State University and participants in Aerospace camp at the University of North Dakota experienced different aspects of aerospace. While the immediate impact is not always obvious, former 4-H members have shared how they were influenced to a career by participating in events and camps.

Technology education was instituted into the North Dakota 4-H program in 1999 with the addition of a state level 4-H Technology Team. Since the start of Tech Teams in North Dakota in 1999, approximately 120 youth have been active members, and have taken leadership roles in Tech Team programs by presenting workshops on a local, state, and national levels including topics of GPS, robotics, digital photography, web design, and how to build a working computer out of spare parts. Tech Team members have volunteered over 200 hours towards presenting technology programs to North Dakota youth. State Tech Team members also gave more than 80 hours teaching adults on topics including their role as a team and LEGO Robotics.

Completion of a project as demonstrated by more than 11,000 exhibits at the North Dakota State Fair shows the ability to set goals and complete them on a definite schedule.

More than 40 youth involved with the project expo shared studies and discoveries at the 4-H Showcase during the North Dakota State Fair. They shared this information, practicing communication skills with the public as well as officials of the event.

**Source of Federal Funds:** Smith-Lever

**Scope of Impact:** Statewide extension

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

Participants in the 4-H Youth Development programs will hold themselves accountable for conduct that reflects caring, citizenship, fairness, respect, responsibility, and trustworthiness.

Youth leadership teams focus on community service, leadership, citizenship, and volunteering. Participating in activities that improves the lives of others, or the community in which they live, develops ownership and a connection to the community helps youth reflect on each of the pillars of character as they develop.

**Impact:** Most people have an idea or concept of good character, but when 51 participants were asked if their knowledge, skills or awareness improved as a result of training in character education, nearly 50 percent responded their knowledge and awareness improved and 27 percent said their skills had improved.

Adults trained to teach youth on the subject of character made the following comments about the programming in reference to knowledge, skills, or awareness:

“Better ideas of communications, better definitions/explanation/examples, knew very little about character programs”

“How to teach character education to students, examples of activities/articles”

“Of the troubles out there with our young people who really want and need our help, I am more focused on what needs to be improved and know I know a little more about how to identify problems and find solutions, realizing it is an all around experience, my actions affect everyone.

**Source of Federal Funds:** Smith-Lever

**Scope of Impact:** Statewide extension

**Key Theme - Youth Development/4-H: Mini-Society**

Youth have a strong interest in entrepreneurship or starting their own business. National Gallup survey's (sponsored by the Ewing Marion Kauffman Foundation) taken in 1994, 1995 and 1999 concluded that six out of ten young people wanted to start a business. When students were asked to rate their knowledge and understanding of starting a business most (76 percent) rated themselves fair to very poor. Youth recognized the importance of education for preparation of starting a business. The predominant response that significantly outweighed all others was “education in school.” (Source: “The E Generation” by Marilyn Kourilshy and William Walstad, 2000) Mini-Society®, or the entrepreneurship course that we implement in North Dakota is designed for 3-7th

grades.

**Impact:** Four hundred young people participated in 30 hours each of entrepreneurship “hands on” learning in 2003 in 22 classroom, after school programs and 4-H clubs in North Dakota. There was a definite decline in the use of the program with the “No Child Left Behind Act,” so we are currently pursuing ways in which to incorporate the learnings from program into the North Dakota academic standards. Current train the trainer programs do incorporate the standards. The value of volunteer hours given to this program equals \$997,878 when \$14.83 is used as the value for one hour. This number does not include preparation and other time spent outside the classroom on the program.

Sample quotes from teacher reports:

3<sup>rd</sup> grade teacher in Williston - “Somebody “leaked” to the press what great things we were doing in our Kids Zone Mini-Society®! The local NBC news affiliate came in on the day of our first auction to do a news report. The reporter was so impressed that the students knew what expenditures and income were.”

3<sup>rd</sup> grade teacher in Ft. Yates - “I want to better incorporate Mini-Society® across the curriculum...”

5<sup>th</sup> grade teacher at Midway Public School - “FANTASTIC!! My 5<sup>th</sup> graders LOVED Mini-Society®. They learned a ton about scarcity, entrepreneurship, how to conduct meetings, taxes, contracts....we eventually linked Mini-Society® to the stock market. It was an excellent hands on learning experience. I’m doing this again next year.”

5<sup>th</sup> grade teacher at Garrison - Major successes - “positive group work, the auction, great creativity in projects, seeing slower students have success, learning to make decisions using different (allocation) methods.”

3<sup>rd</sup> grade teacher in Wahpeton - “Teaching Mini-Society ® has made me a better teacher. I think and respond differently to other class questions. I no longer immediately give the answer or jump in to “solve” the conflict. I now ask questions and allow the students time to research the answers. I guide them but let them do the decision making. This has been a very effective method in teaching decision making skills.” - oral report.

We have received a grant from the Ewing Marion Kauffman Foundation to conduct surveys in two high schools with students who participated in our program in grade school to see if there is any retention of what they learned and whether participants have a different attitude toward entrepreneurship.

**Source of Federal Fund:** Smith-Lever and Ewing Marion Kauffman Foundation

**Scope of Impact:** State

Allocated Resources  
(\$ x \$1,000)

**FY03**

1862 Extension (\$)	Smith-Lever	602
	State	903
	FTE	21.5
1862 Research (\$)	Hatch	34
	State	50
	FTE	1

## **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)**

The duties of the State Board of Agricultural Research and Education are to:

- determine the causes of any adverse economic impacts on crops and livestock produced in this state;
- develop ongoing strategies for the provision of research solutions to negate adverse economic impacts on crops and livestock produced in this state;
- develop ongoing strategies for the dissemination of research information through the Extension Service;
- develop, with the Agricultural Experiment Station and the NDSU Extension Service, an annual budget for the operations of these entities;
- develop a biennial budget request and submit that request to the President of North Dakota State University and the State Board of Higher Education;
- maximize the use of existing financial resources, equipment, and facilities to generate the greatest economic benefit from research and extension efforts and to promote efficiency;
- annually evaluate the results of research and extension activities and expenditures and report the findings to the Legislative Council and the State Board of Higher Education;
- advise the President of North Dakota State University regarding the recruitment, selection, and performance of the Vice President for Agriculture, Food Systems, and Natural Resources, the Experiment Station Director, the Extension Service Director; and,
- present a status report to the Budget Section of the Legislative Council.

The Membership of the State Board of Agricultural Research and Education is composed of:

- President of North Dakota State University or the president's designee;

- Five persons appointed by the Ag Coalition;
- Five persons appointed by the Extension Service's multi-county program units;
- Two members of the legislative assembly appointed by the chair of the legislative council (one member from each political faction);
- North Dakota Agriculture Commissioner (serves as a nonvoting member);
- Vice president for the College of Agriculture, Food Systems, and Natural Resources (serves in a nonvoting capacity);
- Director of the N.D. Agricultural Experiment Station (serves in a nonvoting capacity); and,
- Director of the NDSU Extension Service (serves in a nonvoting capacity).

The term of office is five years and begins July 1. No person may be appointed to a second five-year term. The term for appointed legislators is two years and member legislators may be reappointed.

SBARE holds monthly meetings during the fiscal year that include attendance by agriculture department chairs and research/extension center directors. The meetings focuses on assessing current programs and identifying issues and needs for new programs. The purpose of SBARE is to determine how Experiment Station and Extension budget dollars are allocated for programming. 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 meet several times with industry representatives to gather 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. Members can serve up to two three year terms.

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. Members testify before the legislature for funding support for Nutrition, Youth and Family Science programs. 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 group that could be used in a multi-county area to gather input. Only MPU 4 currently maintains their multi-county advisory group. The rest of the counties are using a focus group approach or a separate county advisory group to determine program issues. One cluster of three counties is forming an advisory group. Three individual counties have their own advisory council. MPU Eight has subject matter focus groups in livestock systems and human development. This year, MPU 10 used the Human Development survey to gather data. MPU 10 also used a livestock meeting to gather citizen data on livestock issues.

MPU coordinators, along with their extension district directors, shared the results of this meeting with agents in each MPU and/or county. 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 Extension 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**

In 1992, the North Dakota Department of Human Services and NDSU Extension Service were legislated by the North Dakota legislature to form the Family Life Education Committee. The

purpose of this committee was to educate and support individuals at all points within the family life cycle with a particular focus on parenting education. The committee meets six times per year to identify issues, plan, implement and evaluate parenting educational programs. The NDSU Extension Service is the primary source of the educational programs and outreach to the state. The Department of Human Services provides funding opportunities to six state family life education centers through a request for proposal process.

## **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.

### **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.

### **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, North Dakota 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.

### **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 SDSU 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 through 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 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.

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.

### **Sugarbeet disease research**

Minnesota and North Dakota rank first and second in production of sugarbeet, providing 54 percent of the nation'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 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.

**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)**
- Integrated Activities (Smith-Lever Act Funds)**

<b>Title of Planned Program/Activity</b>	<b>Actual Expenditures FY 2003</b>
Sugar Beet Program	52,000
Agronomy Program	19,500
Value Added Programs	24,000
Total:	95,500

**Form CSREES-REPT (2/00)**

## **F. INTEGRATED RESEARCH AND EXTENSION ACTIVITIES**

### **Renewable Resources**

#### *EDUCATION:*

\* The first edition of "Rancher's Guide to Grassland Management" was published in January 2003 and out of print by March, with more than 400 copies distributed to eastern North Dakota and western Minnesota farmers and ranchers and natural resource professionals. Sixty-four ranchers participated in the cow/calf and 12-month forage planning workshops. These three workshops impacted 73,450 acres of native rangeland, pastureland, and hayland and 6,091 cattle. More than 80 to 85 percent of the participants were planning to add new range improvement practices or cattle nutritional programs.

\* One-day range and forage management workshops and schools were conducted for 1,070 participants in North Dakota, bordering counties of South Dakota and Montana, Wyoming, and Manitoba, Canada. These programs were designed to introduce and teach ranchers, farmers, land managers, and youth the 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.

\* Thirty youth ages 13-18 participated in the four-day range camp and 112 participated in the State Range Judging Contest. Six other educational programs were taught to youth ages 10 through 18 and undergraduate college students, totaling 167 students. 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.

\* Thirty-two and 35 people participated in the two natural resource educational programs associated with tribal lands on Fort Berthold and Standing Rock reservations in North Dakota and Pine Ridge Reservation in South Dakota. On average, 24 professionals who work on the reservation, five ranchers/farmers, and four students and tribal elders participated in these programs. These 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 from previous needs assessments indicate a need for natural resource educational material and programs to enhance use for small and mid-size ranchers and farmers. There is also a need to be more sustainable on the Tribal lands and to use commodity products within the Tribal areas more effectively. A better understanding and marketability of bison and the natural resources will be addressed as well.

\* Twenty-eight 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. By teaching the sustainable range management to professionals that are the key contact personnel in a county, we can provide educational tools and materials to potentially thousands of land managers impacting hundreds of thousand acres in North and South Dakota. This program was a 2-year project that finished in 2003. An advanced level program will be offered in

2004 and 2005 through the NCC SARE program.

**RESEARCH:**

\* 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 98 percent and 96 percent on single-species and multi-species grazing treatments, respectively, after eight 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 eight 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.

\* 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 15 to 26 percent. These results are from years 1, 2 and 3 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.

\* Nine months post prescribed October dormant season fire decreased herbage production on the seasonlong grazing treatment; however, no significant reductions occurred on the twice-over rotation grazing system or nonuse treatment. Almost a 100 percent kill of club moss occurred from the prescribed fire, irrelevant of treatment.

**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. Soybeans in North Dakota for 2003 had a production value of \$602 million (state ranking for production: 2; ND produces 4 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 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 were 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 was 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. 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 was published and distributed. The publication was: 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 from 2002 and 2003 were also prepared for publication. 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 was presented at the Fourth National Integrated Pest Management Symposium/Workshop in Indianapolis, Indiana, April 8-10, 2003.

NDSU has hosted three EPA representatives (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. A 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). 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.

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 Multistate Extension Activities and Integrated Activities**

**Institution:** NDSU

**State:** North Dakota

**Check one:**

- Multistate Extension Activities**
- Integrated Activities (Hatch Act Funds)**
- Integrated Activities (Smith-Lever Act Funds)**

<b>Title of Planned Program/Activity</b>	<b>Actual Expenditures FY 2003</b>
Renewable Resources	10,000
Beef Education	17,000
Entomology Education	13,000
Total:	40,000

**Check one:**

- Multistate Extension Activities**
- Integrated Activities (Hatch Act Funds)**
- Integrated Activities (Smith-Lever Act Funds)**

<b>Title of Planned Program/Activity</b>	<b>Actual Expenditures FY 2003</b>
Renewable Resources	18,000
Beef Education	23,000
Entomology Education	5,000
Total:	46,000

**Form CSREES-REPT (2/00)**