ANNUAL REPORT OF ACCOMPLISHMENTS AND RESULTS

North Dakota State University

North Dakota State University Extension Service

North Dakota Agricultural Experiment Station

Federal Fiscal Year 2001

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TABLE OF CONTENTS

Goal 1. An Agricultural System that Is Highly Competitive In the Global Economy

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

North Dakota leads the nation in production of hard red spring wheat, durum wheat, sunflower, barley, oats, all dry edible beans, pinto beans, navy beans, canola, flaxseed, dry edible peas and honey. The state ranks second in production of all wheat and third in sugar beets and lentils. Crop production is critically important to the economy of the Northern Great Plains. Cash receipts from crops provide more than $2.45 billion to the economic base of North Dakota. A short growing season and low rainfall limit diversification, yields and cropping potential. Still North Dakota is one of the most agriculturally diverse states in the nation with more than 40 different crops grown.

Similarly, livestock production is big business in North Dakota, accounting for 16.6 percent of the total agricultural cash receipts – $639 million – in 2000. 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.

A key to the success of crop production in North Dakota is the continued genetic improvement of crops. Varieties released in 2001 by NDSU had an annual economic impact based on increased yield alone of about $30 million annually. Alsen, which was recently released, is the first hard red spring wheat variety which combines high quality and good agronomic characteristics with Type II resistance to Fusarium head blight. In addition to its impact in North Dakota, the variety will also have an impact in South Dakota, Minnesota, and to a lesser extent, Montana.

In addition to improvement in the state's major crops, scientists assess minor crop varieties and production practices. These minor crops give producers crop rotation flexibility for dealing with pest and disease problems in major crops and diversify income. Lentil production increased from about 2,500 acres in 1993 to more than 44,000 in 2001. Dry peas increased from 2,000 acres to more than 87,000. Canola increased from 20,000 acres to 1.29 million. Despite its northern climate, North Dakota has 2.1 million acres of soybeans, which is greater than the state's barley acreage.

The micro-rate herbicide system developed at NDSU 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. The micro-rate system in corn weed control is expected to reduce herbicide costs in North Dakota by $16 per acre annually.

Producers who are including a two-year break in their crop rotation based on NDSU recommendations are seeing an increase in gross income of $36 per acre when wheat is grown in rotation compared to comparison to continuous wheat. When alternative or specialty crops are seeded during the two years some producers have report up to $40 per acre return.

NDSU specialists are helping livestock producers hone their management skills too. By the end of this program planning year, 51 farms have been introduced to the North Dakota Dairy Diagnostic Program, a program that uses teams of local experts to help dairy producers identify key areas for improvement. One producer expanded from 87 to 130 cows while maintaining milk production at 57 lbs. per cow per day for a gross economic impact of nearly $86,000. Another instituted herd health and vaccination program which increased milk production from 57 to 71 lbs. per cow per day while lowering feed costs by 37 cents per cow per day on 88 head for a gross economic impact of more than $53,000.

NDSU Extension specialists are working with pork producers and processors in the state to evaluate swine genetics, helping producers make adjustments so the pork they produce better matches consumer demands and processor needs. Ultimately, the effort will add value to the retail products and an estimated $3 to $5 per pig for producers in the state.

Researchers found that potato-processing waste is equal to 50 to 80 percent of the value of corn in finishing cattle diets, but can cut the cost of production depending on the price of corn. In similar research, scientists found that bread byproducts are 110 to 125 percent of the feed value of corn and can reduce the cost of beef production. The co-product value to beef cows in the N.D. Central Crop Reporting district alone is approximately $9 million.

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

In other work nutritionists found that feeding weather-sprouted grains to cattle adds 50 cents to a dollar to the value of a bushel of grain and captures several million dollars in revenue for North Dakota farmers and ranchers.

Researchers developed a nutrition regimen for heifers that can enhance overall animal and mammary development and life-long lactation potential by about 10 percent. For the dairy industry, a 10 percent increase in milk yield represents about 70 million more pounds of milk or an additional $8.8 million to the dairy economy of North Dakota. For the state's beef industry, the improved lactation performance is equivalent to a 20 pound increase in calf weaning weights, representing about $13 million in additional revenue.

Long-term research at NDSU has shown that seeding marginal to highly erodible land to grass and grazing it with beef cattle can return an average profit to land and management of $262 per acre versus about $26 per acre for the same land producing a small grain crop. If 50 percent of North Dakota's CRP acres remain in grass for grazing, the annual increase to the North Dakota economy would total $57 million.

Program 1: Competitive and Profitable Crop Production

Key Theme – Plant Germplasm: Genetic Improvement of Major Crops

The NDSU Agricultural Experiment Station has breeding and research programs in most of the region's major crops with the goal of releasing new varieties. Germplasm from these research programs is shared with public and private breeders worldwide. In sunflower and sugar beet, which are also major crops, germplasm is released by the USDA for use by private and public breeding programs. USDA scientists provide basic genetic information and in some cases develop and provide germplasm to assist the NDSU breeding programs. In some crops, the USDA coordinates regional trials that allow plant breeders to determine the adaptability of their genetic material across a wide range of environments outside North Dakota. The NDSU plant breeders, which are located in the Department of Plant Sciences, cooperate extensively with their counterparts in the Departments of Plant Pathology and Cereal Science and the research extension centers in varietal development and genetic research. Crosses made by the breeder are evaluated for agronomic characteristics by the breeder, quality characteristics by cereal scientists and disease resistance by plant pathologists. 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 accessability 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 and quality factors. Examples include: greater test weight, kernel size and higher protein for wheat; improved milling extraction percentage and lower protein in barley for malting; increased fiber level in oat for

human consumption; specific oat varieties for race horses; and hulless oats for improved livestock feeding efficiency.
Varieties released by NDSU in 2001 had an annual economic impact based on increased yield alone of about $30 million annually. Alsen, which was recently released, is the first hard red spring wheat variety which combines high quality and good agronomic characteristics with Type II resistance to Fusarium head blight. In addition to its impact in North Dakota, the variety will also have an impact in South Dakota, Minnesota, and to a lesser extent, Montana. If the variety is approved for production in Canada, where it is well adapted, it will also have a significant economic impact there.

Other varieties were released for use by oat, durum, six-rowed barley and soybean producers. The acceptance of the two-rowed barley "Conlon" as a malting variety will have a major impact on barley production in central and western North Dakota. The six-row barley variety "Drummond" has been accepted by the American Malting Barley Industry as a malting variety. The benefits will also be felt in Minnesota and South Dakota to a lesser extent. The recent release of several high quality and high yielding durum varieties has had a major impact in northwestern North Dakota and northeastern Montana. The education of producers about the strengths and weaknesses of new varieties is a primary function of the extension service. A typical crop variety lasts 5 to 6 years, at which time it is probably replaced by another that possesses improved agronomic characteristics and yield. If the variety finds a niche area or market, it can last much longer. As a result, there is a continual need for programs to provide producers the option to select those varieties that best fit their needs from public and private breeding programs.

Source of federal funds: Smith-Lever and Hatch

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

Key Theme – Agricultural Profitability: Assessment of Minor Crops

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

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 8 to 9 years ago, became major crops as producers sought increased economic gains or attempted to incorporate them into crop 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 44,000 acres in 2001. Dry peas have increased from about 2,000 acres to more than 87,000 acres during the same period. Canola increased from 20,000 acres to 1.29 million acres. North Dakota, despite its northern climate, has 2.1 million acres of soybean, which is greater than the acreage of barley, an older traditional crop in the region. Other minor, less extensive crops research and extension efforts focused on include carrots, onions and borage.

Source of federal funds: Smith-Lever and Hatch

Scope of the impact: Multi-state Integrated Research and Extension: MN, MT

Key Theme – Plant Production Efficiency: Develop management strategies to sustain crop productivity.

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

Impact – Because varietal sensitivity is the most important factor influencing iron chlorosis in soybeans, pre-screening of experimental lines by soil scientists in cooperation with plant breeders will eliminate sensitive material from being released for commercial products. Since the varieties developed are adapted to North Dakota and to a lesser extent to South Dakota and Minnesota, the research will have regional impact. The micro-rate system has been widely accepted by 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. The micro-rate system in corn weed control is expected to reduce herbicide costs in North Dakota by

$16 per acre annually. This herbicide application method will both increase net economic income and reduce herbicide use.

Source of federal funds: Smith-Lever and Hatch

Scope of the impact: Multi-state Integrated Research and Extension, MN.

Key Theme – Agricultural Competitiveness: Increase the agricultural producer, consumer, government and social sector awareness, understanding and information regarding agricultural systems.

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

Impact - Clientele of the NDSU Extension Service and Agricultural Experiment Station are well-served by the faculty and staff of the plant sciences, soil science, cereal science, entomology and agricultural and biosystems engineering departments. All faculty, both research and extension, provide current and unbiased information to specific producers and commodity and business groups upon request. In addition, information on general problems, practices and procedures are available to the general public for farm, rural, urban, commodity and private industry.

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

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

Source of federal funds: Smith-Lever and Hatch

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

Key Theme - 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 profitability as possibl e.

To help producers with up-to-date 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 printed by the NDSU Extension Service.

Throughout the winter meeting season staff either hold or invite producers to other area production meetings to fine tune their production skills.

Cooperating Institutions/organizations: LaMoure County Extension Office, Allied Agronomy Services of Edgeley, Edgeley Farmers Union Grain Elevator, Farmers Union Oil Company of Edgeley, National Sunflower Association, North Dakota Soybean Council, Soybean and Sunflower Seed Companies, Dr. Mike McMullen, NDSU Oats Breeder, ADM Plant, Enderlin, the LaMoure County Ag Improvement Association and Producers: Tom Kiecker of Edgeley ; Ron VanBruggen of Litchville and Terry Lebhan of Litchville,.

Impact - Because of more favorable prices and problems with disease, many county farmers 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 returns. In 1995 only 7,454 acres were planted into soybeans and 21,375 acres into corn. In 2001 soybean plantings increased to 111,778 acres and corn increased to 56,391 acres. Most of these acres were taken from less profitable hard red spring wheat acres. Wheat acreage in 1995 was 261,901; in 2000 wheat acres fell to 135,130. Economic impact of changing wheat acres to soybean and/or corn acres was approximately $14 million of additional gross revenue for LaMoure County producers

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

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 be leached below the root zone. These demonstrations were observed and discussed with producers at field days and county agricultural improvement tours. Presentations were developed and given to producer groups and were included in the NDSU Extension Service CD which is distributed to county agents across the state.

Cooperating institutions and organizations: North Dakota State University Cooperative Extension Service, Montana State University Cooperative Extension Service, Dickinson Research Extension Center, Hettinger Research Extension Center, County Extension Services and County Crop Improvement Associations in Adams, Golden Valley, Hettinger, Mercer, McLean, Morton, Oliver, and Sioux Counties, 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 that they can produce yields comparable to and sometimes greater than those from fallow. Fallow acreage in southwestern North Dakota has declined by 520,000 acres since the demonstration was initiated. Also, wheat and barley acreage has decreased by 300,000 acres each, indicating that fewer acres of continuous wheat and barley are being sown in this part of the state. In 1996, 72 percent of the wheat planted in southwestern North Dakota was on wheat, barley, or durum stubble. In 2000, 48 percent of the wheat grown in southwestern North Dakota was grown on wheat, barley, or durum stubble. This change may in part be attributed to the work that has been done with this project.

Source of federal funds: Smith-Lever

Scope of impact: Multi-state Extension, MT, ND, SD

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

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

Impact – Six producers indicated that they have already moved sunflower planting dates to occur at or about May 23. It is estimated that these six producers increased income based on year and quality factors by $35 per acre or a total of $105,000. At a sunflower growers meeting in southwestern North Dakota producers were asked how many would consider planting on or about May 23 after hearing this information. Eleven additional producers indicated that they would seriously consider this change in their operation.

Source of federal funds: Smith-Lever

Scope of Impact – Integrated research and extension.

Key Theme – Adding Value to New and Old Agricultural Products: Expeller Pressing of Niche Oilseeds

Expeller pressing of niche oilseeds is of interest to North Dakota processors. In the past year, researchers have focused on processing crambe seed and flaxseed. The results can, in some cases, be readily extended to processing of other oilseeds. Improved processing of these crops increases the likelihood of commercialization within North Dakota. Researchers developed indices for characterizing oilseeds cooked in preparation for pressing.

Impact – Researchers found dehulling, cooking and expelling in combination achieved oil yields of up to 87 percent. The relationships are expected to be similar in other edible oilseeds.

Source of federal funds: Hatch

Scope of Impact: Statewide research

Key Theme: Agricultural Competitiveness – Use of Econometric Models to Predict Market and Policy Effects

NDSU economists develop econometric simulation models to predict impacts of changes in world trade, agricultural and monetary policy, trade practices and grain quality characteristics. The Global Wheat Policy Simulation Model helps economists predict both U.S. and world wheat economies. The sugar policy simulation model includes 18 major sugar producing and consuming countries and helps producers, policy makers and the sugar industry evaluate trade and domestic agricultural policies. Another model evaluates impacts of U.S. dollar values on U.S. agricultural competitiveness in global markets.

Impact – The importance of the work in agricultural policy and international trade conducted by NDSU was recognized this year by a federal appropriation of more than $2 million to conduct research and outreach activities in areas of importance to the agricultural economy of the Northern Great Plains. Results of the work provide an framework for discussion on agricultural and trade policy. Some key results include:

- Word demand for wheats will grow faster than world production and prices will increase 36 percent for durum wheat and 23 percent for common wheat from 1999 to 2009.

- Models indicate the U.S. sugar industry may be able to survive at current costs and asset values if both the United States and the European Union liberalize their sugar trade while sugar subsidies remain in other counties. However, if only the United States eliminates its sugar programs, all U.S. sugar producing regions would be threatened.

- The strong U.S. dollar has resulted in reductions in U.S. market shares in the Asian market. In addition, trade flows of livestock between the United States and Canada under CUSTA, especially beef cattle, pork and poultry, were such that Canadian exports of livestock products lowered U.S. domestic prices and cut farm income.

- Analyses confirm that the impact of DON (a mycotoxin found in grain infected with Fusarium head blight) on average crop values has changed drastically in recent years. Results indicate that the selling discounts for DON (averaged over all bushels of barley sold as malting) fell by about two thirds between 1998 and 1999. However, DON remains a major determinant of cross border flows of malting barley between the United States and Canada.

Source of federal funds: Hatch

Scope of impact: Multi-State Research, KS, MT, NE, SD

Key Theme: Emerging Infectious Diseases – Sugar Beet Disease Research.

North Dakota ranks third in production of sugar beets, providing 16 percent of the nations's supply. Sugar beet production in the region continues to sustain considerable loss from disease. Losses to

Cercospora leaf spot in North Dakota and Minnesota were estimated at $113 million in 1998, and costs of four applications of fungicide control in 20 00 were as high as $66 per acre. Some isolates of Cercospora were found to be tolerant of fungicides.

Impact – Researchers tested a prediction model for timing fungicide applications and studied the lines of the fungus that were tolerant to fungicides. The research will lead to improved fungicide application techniques, and genetic markers within the fungicides will help researchers monitor the tolerance and design techniques for improving control of the disease. Researchers in North Dakota and Montana are looking at control strategies that integrate disease resistant crops and fungicide applications. Another project showed that biocontrol and biorational materials increased tonnage and sugar conten t of beets exposed to Aphanomyces disease.

Source of federal funds: Hatch and Smith Lever

Scope of Impact: Multi-state research and extension: ND, MN, MT.

Key Theme: Ornamental/Green Agriculture – Woody ornamental evaluation

Several hardy woody landscape and tree species adapted to North Dakota have been released by NDSU. NDSU has released 20 superior cultivars in recent years and six more are nearing release. In addition, researchers evaluate hundreds of woody plants for performance and hardiness in N orth Dakota. Researchers are beginning the third year of evaluations on 100 cultivars of flowering crabapple and those evaluations will lead to significant revisions in recommendations made to nurseries, landscape companies and their clientele. Evaluations were made on 375 other woody accessions, many at multiple sites in the state. NDSU researchers collaborate in national and regional nursery plant evaluation programs.

Impact: The inventory of hardy plants for production and sale in the industry and use by landscape architects/designers, developers, city arborists, foresters, horticulturists, parks, golf courses, conservation and the public has increased markedly. That inventory is selected largely based on recommendations from NDSU's program and it's co llaboration with researchers across the region.

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

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

Program 2: Competitive and Profitable Animal Production

Key Theme - Agricultural Profitability: ND3P (North Dakota Dairy Diagnostic Program)

After a successful Dairy Diagnostic Advisory Team pilot program, the extension dairy specialist in collaboration with the North Dakota Dairy Strategic Planning Task Force launched a public effort

before the legislative assembly to secure more direct funding for ND3P - North Dakota Diagnostic Program. These efforts eventually resulted in additional appropriations of $50,000 per biennium directly to the NDSU Extension Service, earmarked for ND3P development. In addition, the task force and selected pilot program participants convinced the North Dakota Agricultural Products Utilization Commission to provide significant funding for the second phase of this program; to grow the concept into a state-wide educational effort by offering ND3P services to all dairy farm families in the state.

The task force remains in an advisory capacity to the program and is involved in efforts for future funding. The group consists of producers, industry leaders , agricultural financial advisors, government and regulatory personal, as well as the extension dairy specialist. A state-wide coordinator and two facilitators (all part-time) initiate, implement, and maintain 10 to 20 farm teams each. The dairy farm family's own personal advisory team consists of a unique combination of various service providers who have a vested interest in the success of the dairy farm business. All advisory teams are required to help the farm families prepare and record a set of attainable goals and design a mission statement at the onset of the program. There is no perfect team as each farm family has a variety of different needs and available resources. Rather, ND3P is the conduit that helps provide the right service for the most demanding needs. The ND3P providers continue to encourage team development and growth. The farms are responsible for maintaining accurate records and implementing those ideas that meet the goals of the farm.

The program's intent is to analyze dairy farm enterprise(s) through teamwork and provide training on communication and facilitation skills for both the farm family and the supporting team members. Key outcomes taken from the evaluations provided by the program users include: the value of setting goals and monitoring progress, developing trust between the farm and their service providers, reducing professional barriers among advisors, learning to communicate more effectively, the value of hearing others acknowledge success, and synergism through team efforts.

Current goals are to establish teams on 10 percent of North Dakota dairy farms, to secure additional funding from private industry, look to outside grant agencies for funding, and develop a plan to sustain growth and development.

Impact - By the end of this program planning year, 51 farms have been introduced to the ND3P concept. While the level of active participation varies by team, about half of those currently expressing an interest in this program paid thei r participation fee. Some of the more significant success stories include:

Farm 1. Expanded from 87 to 130 cows while maintaining milk production at 57 lbs. per cow per day for a gross economic impact of nearly $86,000.

Farm 2. Instituted herd health and vaccination program which increased milk production from 57 to 71 lbs. per cow per day while lowering feed costs by 37 cents per cow per day on 88 head for a gross economic impact of more than $53,000.

Farm 3. Milk production increased 9.2 lbs. per cow per day on a herd of 34 cows. Feed costs decreased 37 cents per cow per day for a gross economic impact of nearly $15,000.

Farm 4. Milk production increased 12.4 lbs. per cow per day on a herd of 54 cows while milk quality increased. Gross economic impact was more than $40,000.

Farm 5. Increased milk production 17.6 lbs. per cow per day on a herd of 33 cows for a gross economic impact of more than $20,000.

Farm 6. Milk production increased 6.6 lbs. per cow per day on a herd of 210 cows because of feed ration adjustments. Gross economic impact was more than $48,000.

Source of federal funds: Smith Lever

Scope of impact: State specific

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

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

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

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

An additional initiative was also implemented with the 2001 voluntary Johne's control program called the "C-punch." To control Johne's in cattle, a permanent identification needs to placed on the animal. Some states have instituted a "J-punch" program whereby infected cattle are ear notched with a letter "J" to signify Johne's. In North Dakota we were concerned about stigmatizing producers and their cattle by placing a "J" in the cattle's ear. In response the "C-punch was developed. The letter "C" stands for cull. Animals ear notched by this means signify to sale barns, order buyers, and other potential purchasers of livestock that cattle marked with a "C" are intended for the slaughter market only and are not to be put back into a production unit. The "C-punch" signifies that an animal is

intended for cull only. It does not imply a production unit is infected with Johne's. "C -punches" have been provided to all livestock auction markets across the state and to veterinarians and producers who wish to use the device. Multiple states have contacted North Dakota with the desire to start a "C-punch" program.

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

Source of federal funds: Smith-Lever

Scope of Impact: Multi-state research and extension.

Key Theme – Animal Production Efficiency: Animal Genetics – Swine

Extension specialists have put together a consortium of meat packer/processors, producers and extension personnel for evaluating the current status of genetic sources in North Dakota and how those genetics impact the final products provided for consumers. This project involves lean percentage in the carcasses plus the meat quality traits and the size of retail portion. The involvement of the three groups gives a greater impact than a program initiated by extension alone.

Impact – Producers were exposed to the need for genetic change in the state's hog population at the annual Pork Producer's meeting. The attendance of about 40 people represented about 25 percent of the state's hog production. In addition some producers from Minnesota who are considering shipping hogs to the slaughter facility in North Dakota attended. Discussions about procedure of data collection and the involvement of the packer were discussed at the packer/grower alliance meeting. This project will take approximately two years for data collection and analyses before recommendations are made to producers. Ultimately, the effort will add value to the retail products and an estimated $3 to $5 per pig for producers in the state.

Source of federal funds: Smith-Lever

Scope of impact: State specific

Key Theme: Agricultural Competitiveness - Animal Production Systems

Use of the swine model for evaluating potential new swine units has been done by producers. They have used results from the model to work with lenders to assess expected cash flows and overall estimated investment capitol needed. The NDSU Beefsim model also has been completed and is ready for use by producers, consultants and lenders in evaluating expected cash flow and potential economic impact of beef operations in the state.

Impact – Consultants in the state have used the swine model results in formulating busines s plans for economic development. These business plans are being studied by economic development groups and producer cooperatives for determining potential benefits from new swine facilities. The Beefsim model has been evaluated by extension, teaching and research personnel within the NDSU system. The model is being used in production courses at NDSU and the model is undergoing final testing by a group of industry specialists. This model offers a new approach for beef producers to evaluate their current production methods compared to changing production techniques. The model will be presented to producers during the coming year. Except for teaching benefits, the impact is difficult to determine now.

Source of federal funds: Smith - Lever

Scope of impact: State specific

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

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

Impact - This grassroots approach to marketing lamb to increase producer returns has yielded a membership of 104 members in the cooperative from North Dakota, South Dakota, Minnesota and Montana. The coop was successful in landing a $250,000 USDA marketing grant, plus other grants totaling $181,000. 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 quali ty incentives for leanness and loin eye size. Having gained the attention of several very large customers, the cooperative made the decision to conduct a second equity drive to obtain the additional lamb that is required along with the capital needed to de velop those markets. The equity drive is now in progress. The Dakota Lamb Growers Cooperative is probably one of the bright spots in the North Dakota sheep industry as a value added industry.

Source of federal funds: Smith-Lever

Scope of impact - ND, SD, MN, MT

Key Theme - Agricultural Profitability: Feedlot Development in North Dakota

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

Impact - The NDSU Extension Service showed that it cost up to 3 cents less per pound to finish cattle in North Dakota compared to an out-of-state feedlot. Extension information prompted a group of cattle producers to pool funds and custom feed more than 4,500 head in North Dakota feedlots. With help from extension specialists and agents, they realized a return of more than 31 percent in one year. Another group built a 7,000-head feedyard in Bowman County. Other producers will earn a premium of up to 3 cents per pound for cattle that meet processing specifications of a new local processing company. More than 220 producers attended extension feedlot schools in the last two years. Lenders are exploring additional financing of cattle, feed and cattle feeding facilities in North Dakota. One participant estimated that better health practices, bunk management and feeding practices cut his cost of gain by up to 5 cents per pound.

Source of federal funds: Smith-Lever

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

Key Theme - Agricultural Competitiveness: Leadership and Economic Development

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

Impact - Cattle producers in central North Dakota realized that working as a group would provide more economic development than could be accomplished individually. Through educational sessions and continued facilitation and instruction, producers were able to develop several new vertically

integrated cattle business ventures. The cooperative cattle feedlot plan has constructed a 7000-head cattle feedlot located in a cow-calf region where feed grains are traditionally low priced. The limited liability partnership that owns cattle for custom feeding has returned a 23.5 percent return on equity during a one-year period for 23 cattlemen involved. Other cattle feeding alliances have been developed as limited liability partnerships (LLP) and limited, limited liability partnerships (LLLP).

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

Source of federal funding - Smith-Lever

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

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

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

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

Source of federal funds: Hatch

Scope of Impact: State Specific

Key theme - Adding Value to New and Old Agricultural Products: Rural economic development through value-added livestock production.

Southwest Feeders is a multi-faceted project being developed to enhance value-added economic development in southwestern North Dakota. North Dakota State University will operate in a proactive manner, stimulating value-added agricultural activities through a coordinated education and research effort. This will differ from many current and traditio nal methodologies of supporting agriculture by focusing multiple disciplines on a single problem and using increased economic activity as a definable outcome. Enhanced economic activity in southwestern North Dakota will occur through the backgrounding of beef calves and finishing of lambs. These are viewed as viable mechanisms for converting existing agricultural resources (e.g. livestock, feed, facilities, and labor) into additional economic activity.

There is an urgent need for increased economic activi ty in southwestern North Dakota. The efficient utilization of locally available agricultural resources to add value to beef calves and lambs is a viable mechanism for addressing this need. The Southwest Feeders Project is designed to actively engage the agricultural community of southwestern North Dakota in value -added livestock production through a coordinated and targeted program in calf backgrounding and lamb finishing.

Adequate financial support has been pledged to initiate this project in 2002. The i ncreased awareness the development of this project has generated has increased the number of producers inquiring about value-added postweaning management options for beef calves and lambs. On the beef side, this is strongly encouraging given the strength o f current calf prices at weaning. An annual Feeders School (late summer) and Feeders Day (late winter) are being developed for initiation in 2002 -2003. A feeding facility will be developed in the summer of 2002 with calf backgrounding to begin in the fall followed by lamb finishing in the spring.

Local banks and economic development organizations from southwestern North Dakota, ND Barley Council, ND Corn Utilization Commission and various state and federal entities have pledged financial support for the in itiation of this effort.

Impact -There is in excess of $20,000,000 in new and potential economic activity available to the agricultural community of southwestern North Dakota associated with beef backgrounding. Statewide the potential level of economic activity exceeds $55,000,000. Lamb finishing would increase the statewide level of economic activity by $2,100,000. The combination of resources available for value - added economic development from livestock is not restricted to this area of North Dakota. Northwestern South Dakota, southeastern Montana and northeastern Wyoming have similar agricultural characteristics and expansion of this project into this region would seem appropriate. The recent development of a Value-Added Ruminant Animal Consortia (VARAC) involving these four states is an example of this possibility.

Source of federal funds: Smith-Lever

Scope of Impact: Multistate integrated research and extension, MT, SD, WY.

Key Theme: Animal Production Efficiency – Feed Utilization

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

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

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

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

Researchers have developed a nutrition regimen for heifers that can enhance overall animal and mammary development and life-long lactation potential by about 10 percent. For the dairy industry, a 10 percent increase in milk yield represents about 70 million more pounds of milk or an additional $8.8 million to the dairy economy of North Dakota. For the state's beef industry, the improved lactation performance is equivalent to a 20 pound increase in calf weaning weights, representing about $13 million in additional revenue.

Source of federal funding: Hatch and Smith Lever

Scope of Impact: Statewide research and extension

Key Theme: Animal Production Efficiency: Swine Production

A major problem facing swine producers operating farrowing units is the reduced size of most second litters. In addition, producers on the Northern Plains look to locally produced crops for cost effective rations. Sow energy levels in diets are important as are methods that reduce environmental stress.

Impact – Researchers found that Regumate in sow diets increased farrowing rate and number of piglets by 1.5 to 2 in the second litter and reduced the number of nonproductive days by 10 to 15. Sows fed a diet of 10 percent field pea weaned more piglets. Researchers found that peas, a relatively new crop in North Dakota, could be incorporated into pig diets without compromising sow performance, milk composition, return to estrus, litter performance and litter survival rate. They also found that hoop confinement for a commercial 1000 hog unit would generate an estimated $6,000 more in net return than conventional confinement.

Key Theme: Aquaculture – Northern grown crops as feed ingredients

Concerns associated with animal-based feeds such as high prices and the spread of disease create concerns for the aquaculture industry, which has relied on animal -based proteins as a key feed ingredient.

Impact – NDSU researchers found that both field pea and soybean meal appear suitable as feed ingredients for carnivorous fish diets. The research could open new diets for northern -grown crops and could lead to an expanded aquaculture industry on the Northern Plains.

Source of federal funding: Hatch

Scope of impact: Statewide research

Key Theme: Grazing – Reclaiming native grasslands.

Reclaiming diverse and seasonally balance native grasslands is difficult due to the competitiveness of cool-season native and introduced grass species. Proper grazing ma nagement of rangeland should improve sustainable forage production from these lands.

Impact: Range scientists showed that early summer cattle grazing improved plant species diversity and the seasonal balance on study grasslands. In the study, warm-season grass species increased from 6 to 42 percent of cover following grazing while introduced cool -season grass species decreased from 47 to 6 percent of the species composition of pastures.

Source of federal funds: Hatch and Smith Lever

Scope of impact: Multistate research and Extension, MT, SD.

Key Theme – Grazing: Managing highly erodible land.

Nearly three million acres of marginal to highly erodible land in North Dakota have been reseeded to perennial grass in the past 12 years through the Conservation Reserve Program. As contracts expire,

producers must consider how to manage those acres. Options include returning the acres to crop production, grazing or haying.

Impact: Long-term research at NDSU has shown that seeding marginal to highly erodible land to grass and grazing it with beef cattle can return an average profit to land and management of $262 per acre versus about $26 per acre for the same land producing a small grain crop. If 50 percent of North Dakota's CRP acres remain in grass for grazing the annual increase to the North Dakota economy would total $57 million.

Source of federal funds: Hatch

Scope of impact: Statewide research.

Key Theme - Rangeland/Pasture Management: Renewable Resources

An integrated extension and research program was developed to improve rangeland management across the state. Key components of the effort included:

Extension–

***** A 12-month grazing and forage planning workshop (two - and three-day): Three intensive grazing and forage sessions were held in Dickinson, near Amidon, and Ellendale, North Dakota for livestock producers. Ranchers learned to improve their rangeland management skills and develop year -long forage use strategies.

* One-day range management workshops were conducted at 16 locations in North Dakota. These one-day programs are designed to introduce ranchers and farmers to range management principles that can enhance grazing management 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, a ndwildlife enthusiasts. They learned basic fundamental range management practices and how to judge the resource for health and value for forage and wildlife habitat.

* Conduct two-day needs assessment for natural resource management on tribal lands in North and South Dakota: These assessments were conducted at Fort Berthold and Sitting Bull, North Dakota and Pine Ridge, South Dakota and concentrated on local ranchers and farmers, professionals in the region, and students at the colleges.
* Conduct two three-day in-service training sessions for North and South Dakota extension agents/educators and North and South Dakota Natural Resource Conservation Service conservationists.

Educational professionals in North and South Dakota were taught using class ro om and field activities under a sustainable agricultural program for western rangeland.

Impact - Sixty-five ranchers participated in the 12-month planning workshop. Roughly 76 percent of the ranchers were beginners in developing new grazing strategies while the remaining individuals were looking to further improve their current grazing and forage programs. These three workshops impacted almost 120,500 acres of native rangeland, pastureland, and hayland. Over 73 percent of the participants were planning to add new range improvement practices and over 86 percent planned to implement some of the training strategies learned in the workshops.

One-day range and forage management workshops were conducted for 656 participants in North Dakota and bordering counties of South Dakota and Montana. These programs were designed to introduce ranchers, farmers, and land managers to proper resource management tools and management strategies to improve efficiencies of the land base. These producers were then introduced to the more intensive two or three day workshops that would concentrate on their land base.

More than 40 youth ages 13-18 participated in the four-day range camp and more than 140 participated in the State Range Judging Contest. We believe any involvement of youth in the importance of the range resource and fundamental needs for managing these lands will create a more well -rounded adult.

Fifty-one people participated in the needs assessment sessions associated with tribal lands on Fort Berthold and Standing Rock reservations in North Dakota and Pine Ridge Reservation in South Dakota. Twenty-one professionals who work on the reservation, 10 ranchers/farmers, and 20 students and Elders participated in these needs assessment. These assessment programs were developed to help guide us in developing educational programs, demonstration projects, and research projects on tribal lands in North and South Dakota. Results of these assessments will be available in March 2002.

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

Research -

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

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

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

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

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

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

Source of federal funds: Smith-Lever and Hatch

Scope of Impact: Multi-state Integrated Research and Extension, S.D. MT. WY

Program 1

Allocated Resources

($ x $1,000)			**FY01**
1862 Extension ($)	Smith-Lever		952
	State		1,360
		FTE	34
1862 Research ($)	Hatch		1,428
	State		2,100
		FTE	42

Program 2

Allocated Resources

($ x $1,000)			**FY01**
1862 Extension ($)	Smith-Lever		378
	State		540
		FTE	13.5
1862 Research ($)	Hatch		245
	State		360
		FTE	7.2

Goal 2: A Safe and Secure Food and Fiber System

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

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

Producers in north central North Dakota stored sunflower seed infected with the disease Sclerotinia following best harvest practices established by NDSU and 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 markets. Producers were trained on the biology and management of Sclerotinia for sunflower and other susceptible crops.

Based on NDSU research and recommendations, producers used fungicides as a management strategy on 800,000 acres of wheat and realized an average return of $35/acre, resulting in an additional $28 million revenue to producers who used this strategy. 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 Fusarium Head Blight.

NDSU specialists helped develop and implement biological control methods for leafy spurge, a plant that infests large areas of rangeland and reduces its grazing value. This effort is expected to be valued at $58 million per year by 2025 by restoring thousands of acres of rangeland to productivity and by reduced herbicide costs. Once established, biological control of leafy spurge and other pests will provide self-sustaining control without further input cost to the grower.

Growers in the tri-state area of North Dakota, Minnesota and South Dakota and in Manitoba profit from resistance to pests in the major crops developed by crop breeders at NDSU. Resistance to Fusarium Head Blight alone is worth millions to cereal growers.

In the past six years, more than 1,500 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. In follow-up surveys, 65.9 percent reported they

washed their hands more often when preparing food, 65 percent had shared the workshop materials with other people, 57 percent reported using food thermometers more often, and 43.5 percent had changed their cooling practices to use ice baths or smaller containers.

The Family Nutrition Program focuses on increasing the ability of individuals and families receiving food stamps to make wise use of their food dollars. Staff received intensive training on the USDA "Thermy" campaign. Participants in the food safety classes received food thermometers to insure proper cooking temperature of their food. Follow-up evaluations show about 98 percent improved food safety practices.

NDSU developed four new courses in food safety and a minor program of study in food safety was developed and implemented. In addition, the Great Plains Institute of Food Safety was established. More recently, the institute's educational offerings were expanded to include a major, 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. Thus far, every student completing the food safety minor who wanted a job in food safety has obtained one.

In preliminary NDSU research, the addition of potato peel extract extended the shelf-life and color of beef by up to four days, a significant improvement for meat retailers. If successful, the product may provide additional income to potato producers and processors in North Dakota.

NDSU research on checking (crack formation) in dried spaghetti indicated that gluten strength and drying temperature affected the occurrence of checking. Strong gluten or an ultra-high drying cycle can reduce checking, the research showed. NDSU research on differences in gluten strength among varieties will also help breeders develop wheat varieties with specialized processing characteristics. The resulting varieties will help producers increase the value of their crops and enter specialty markets. Crop quality evaluations help industry groups market durum to domestic and foreign buyers.

NDSU researchers found that white vinegar was the most effective among household sanitizers at reducing E. coli levels and other bacteria. Sensory evaluations showed that lettuce treated with diluted sanitizers were acceptable to consumers. The study may lead to easy-to-use home treatments for lettuce and other produce that may significantly reduce the threat from food-borne pathogens.

Key Theme - Food Security: Sclerotinia Disease Development in Sunflower

Sclerotinia is a major disease of broadleaf crops in northeastern North Dakota. Due to the increased acreage of susceptible broadleaf crops, this particular disease is becoming a greater problem over larger areas. For example, in the fall of 1999 wet weather resulted in statewide problems with Sclerotinia head rot disease of sunflower causing losses reaching 60 to 70 percent in some areas. The National Sunflower Association estimated losses in 1999 alone at $1 million. Especially hard hit were confectionary sunflower producers who produce seeds for human consumption and bird feed. Sclerotinia tolerance levels are very low for confection seed producers and if sclerotia bodies or damage to the seeds exceeds 3 percent the field is rejected for human consumption. Producers in 1999 and 2000 were faced with the problem of what to do with highly contaminated confection sunflower seeds. Extension specialists worked with a group of farmers in north central North Dakota to determine if significant reductions in sclerotia contact could be obtained through harvest machine adjustments or in cleaning of the grain sample after harvest. Field studies in the fall determined that some techniques might reduce harvested sclerotia body content, but a more thorough cleaning with specialized equipment would be necessary to reduce sclerotia content, and to some degree dark seed content, in confection seeds. Information gathered in the study was ultimately compiled into an extension publication that was widely used in the fall of 2000 as this problem reoccurred. Additional information on the biology and management of Sclerotinia in sunflower and other susceptible crops was made available in 2001 via training sessions and via contributions to a CD-ROM provided to county and area agents for grower training.

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

Source of federal funds: Smith-Lever

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

Key Theme - Food Security: Fusarium head blight in Wheat

Fusarium head blight (FHB or scab) is a major disease of spring wheat and durum wheats 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 occurred in north central, northwest and northeast North Dakota as a result of long periods of wet weather coinciding with the flowering period of the crops, conditions favorable for the disease. Yield losses in the region ranged from 10 to 90 percent and were especially severe in susceptible durum fields. Fungicide trials established in the affected regions indicated that proper timing of an appropriate fungicide resulted in yield increases of 10-12 bushels/acre and corresponding increases in test weight and market grade. Economic returns from use of the fungicides were between $33-$44/acre, because of increased yields and associated improved quality factors. Extension specialists provided this information on fungicide results to growers via numerous county and regional meetings, demonstrations, and news releases. The extension plant pathologist applied for a Section 18 emergency exemption for a specific fungicide with the best efficacy against the disease, and it was granted by EPA. The fungicide was applied to approximately 800,000 acres of wheat and an average net return of $35/acre was realized, after cost of fungicides, indirect and direct costs were subtracted from the gross return/acre.

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

Source of federal funds: Smith-Lever

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

Key Theme - Food Security: Biological Control

Natural enemies are an essential component of a sustainable farm ecosystems. A major research and extension effort involving the departments of entomology, plant science, and animal and range sciences is

underway 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 underway. *Sclerotinia*, a major limiting disease of most broad leaf crops in the area, is targeted for control by several parasitic fungi. Basic research on the biocontrol of soilborne diseases is being conducted to find new ways of combating serious root diseases of crops such as Rhizotonia and Fusarium root diseases cause substantial losses and are difficult to control. Transformation with carboxin resistance was accomplished for BNR. Two of the transformants showed biocontrol activity.

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

Source of federal funds: Smith-Lever and Hatch

Scope of Impact: Multi-state Integrated Research and Extension. Growers in ND and the surrounding states benefit from the leafy spurge biological control program. Leafy spurge flea beetles are redistributed in ND, MN, WY, SD, NB and MT.

Key Theme - Food Security - Genetic Resistance to Pests

The identification of pest resistance genes, their characterization, and genetic nature are major goals for research programs of insect and disease pests of a number of crops. Sources of resistance to the sunflower midge are being sought in existing sunflower germplasm and varieties. Improved methods to screen for resistance and to characterize the functional nature of sunflower midge resistance are being made. Fusarium head blight (FHB) caused disastrous losses in small grains in the Dakotas and Minnesota between 1993 and 2000. Plant pathologists and breeders developed testing programs for FHB and tested thousands of lines in the field and greenhouse programs. The NDSU released variety Alsen combines FHB resistance with other traits to reduce losses from the disease. This should significantly reduce losses due to FHB. The potato breeding program has a major objective of developing cultivars with late blight resistance. Several selections have been identified with good resistance to the new

genotypes present in the US. One objective of dry bean pathology is to identify new sources of resistance to rust and white mold for the bean breeding program and incorporate this resistance into new varieties. Incorporating disease resistance genes into soybean cultivars has major impact on improving soybean production and profitability for growers. Extensive research in this area is now producing soybean cultivars with disease resistance.

Impact - Genetic crop resistance to pests provides growers with a simple pest management tactic that works under conditions unfavorable to natural enemies and pesticides. Genetic crop resistance eliminates or reduces the need for other pest management inputs and reduces grower expense. Genetic crop resistance saves growers management time because of reduced need for monitoring of pest populations. The economic impact of the FHB resistant wheats should result in millions of dollars saved over growing FHB susceptible cultivars. This will also save huge amounts in reduced fungicide sprays. Late blight resistance in commercial potato production could save millions in reduced spray appl ications 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 produ ction 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 dollars of harvested potatoes rotted.

Key Theme - HACCP

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 de manding 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 six years, more than 1,500 food service managers and employees from restaurants, nursing homes, hospitals, daycare centers and schools in over 100 different North Dakota cities have attended NDSU Extension Service food safety workshops held through the state. The four- to six-hour

workshops focus on the Hazard Analysis and Critical Control Point (HACCP) approach to food safety that was developed by NASA to ensure safe food for its astronauts.

Impact - On the follow-up surveys, 99 percent rated food safety as something "very important" to them. About 74 percent reported telling other people about what they had learned, 65.9 percent reported they washed their hands more often when preparing food, 65 percent had shared the workshop materials with other people, 57 percent reported using food thermometers more often, and 43.5 percent had changed their cooling practices to use ice baths or smaller containers.

Key Theme – Food Safety

Despite widely publicized foodborne illness outbreaks associated with undercooking foods, particularly ground beef, only 6 percent of consumers "sometimes" or "always" measure the temperature of burgers with a food thermometer (USDA-FSIS). Research has shown that color of meat does not ensure that it has reached a safe internal temperature. The purposes of the "Thermy Project" were to develop culturally appropriate lessons, evaluation tools, posters and handouts based on the national "Thermy" campaign to promote use of food and refrigerator thermometers; to pilot test the materials on a reservation; and to increase the monitoring of final cooking temperatures and food storage temperatures among Native American families. Educational sessions were conducted and thermometers were distributed at commodity food distribution sites, senior centers, Head Start centers and in Women, Infants and Children (WIC) offices. Follow-up classes were conducted at least one month after the initial training and refrigerator thermometers were distributed. The materials were also used in statewide programming targeting limited income audiences through the EFNEP/FNP programs.

Impact

In the pilot project conducted on a reservation, about 96 percent of participants reported preparing meals at home for themselves or others at least one time per week, and 96 percent planned to use the food thermometer they received. About 82 percent of the participants identified eating undercooked ground beef as "not safe at all" on the pre-survey, and 96 percent, on the post-survey. About 62 percent reported using the food thermometers at least one time in the previous month, and 93 percent planned to use the refrigerator thermometer they received.

In the statewide programming targeting limited income audiences, 90 percent of the respondents to a follow-up survey indicated that using food thermometers can help prevent foodborne illnesses, and 72 percent of the participants reported using the food thermometer at least one time in the previous month.

About 80 percent reported feeling "more confident" they were serving safe foods to their families when they used a food thermometer.

General food safety programming was conducted by the Family Nutrition Program, which targets limited income audiences with food safety information as well as information on improving nutritional practices, food security and stretching the food dollar. Follow-up surveys for the classes, displays and other methods used by the nutrition education assistants/agents have shown positive changes in food handling behavior. In follow-up surveys, 95.1 percent indicated they less often let food set out more than 2 hours, 98.4 percent indicated they washed their hands more often before touching food, 98.5 percent indicated they keep raw meat separate from other foods more often, and 98.9 percent indicated they cook meat and eggs thoroughly more often.

Source of federal funds: FNS, USDA, Food Stamp Program

Scope of Impact: Statewide Extension

Key Theme - Food Security: Preventative Pest Management

Emerging pests can cause severe economic losses for growers if their potential impact is not anticipated and if controls are not available. New crop varieties, tillage and other farming methods, changing weather patterns, and federal programs influence production practices. In turn, these changes affect the pest insect and pathogen populations that are part of our agricultural ecosystem and can result in emerging pest problems. Although *Lygus* bugs have always been part of our agricultural landscape, historically their populations have been low and it is only in the last two years that they have become economically important. Changes in cropping practices are thought to have made the environment more favorable for *Lygus* bug populations to increase to the point where they are impacting sugar beet and sunflower, and possibly canola. Studies are underway to understand *Lygus* population dynamics, measure its impact per insect, and determine if *Lygus* will be a long-term problem. The soybean aphid, *Aphis glycines*, was found in eastern North Dakota during August and September of 2001. Extension and research programs are being organized to document the soybean aphid's establishment, life history, management, and potential for host plant resistance. Projects are state and regional in scope. Over 700 wheat fields and 150 barley fields are surveyed for leaf and head diseases and insect problems. Every county was surveyed. Survey reports were summarized and provided information for the Crop and Pest Reports, which are widely distributed and discussed at several meetings. A new race of leaf rust was identified on commonly grown spring wheat varieties in the mid 1990s. This race increased and caused severe losses during the late 1990s. Producers abandoned the most susceptible varieties. Unfortunately, the abandoned varieties had some of the best levels of FHB resistance. A new variety with FHB and leaf

rust resistance was released in 2000. This was the last potato growing area where the form of late blight, A2, was not found, so an extensive field and storage survey was established. A new mating A2 was found in the disease storage survey. Late blight of potato has been epidemic in North Dakota every year since 1992, partly because of the appearance of the new A2 mating types (US 8), which are more aggressive and resistant to the fungicide metalaxyl that previously controlled the disease. Potential new or invasive pests species include the cabbage pod weevil, cereal leaf beetle, star thistle, salt cedar, knapweed, toad flax, and purple loosestrife. These are being monitored for establishment and impact.

Impact - Unexpected pest problems arising from emerging or new pests can result in severe economic impact for growers. Preventative pest management assesses potential problems and devises pest management solutions before the pests become economically important. Pest alerts and management solutions are provided so that growers can make educated decisions regarding their options. The economic impact of wheat leaf rust on scab tolerant cultivars was estimated at over $20 million. The release of the new rust and FHB resistant cultivar should alleviate much of this loss. An annual survey reports new diseases or insects and the severity of these pests. This information is widely used for management and spray decisions. The economic impact of the new A2 mating type in late blight has been a complete change in management practices by the potato industry. A cooperative sunflower survey in 2001 for the states of North Dakota and South Dakota have helped to determine the incidence of pest problems for the sunflower industry. The survey has provided valuable insight into the *Lygus* issue facing the confectionary sunflower industry. Continued surveys will help assess the success of *Lygus* management recommendations. NDSU has led the development of these new management practices.

Source of federal funds: Smith-Lever and Hatch

Scope of Impact - Multi-state Integrated Research and Extension. Growers in ND profit from the disease and insect survey and corresponding management recommendations. Information is also beneficial to areas surrounding ND i.e., Red River Valley. The 2001 sunflower survey has identified key pest issues for growers in both Dakotas. Growers especially in ND but also the tri-state region will benefit from the release of the new wheat leaf rust and FHB resistant wheats. Growers in the potato growing areas of the tri-state area profit from the development of the new management practices for the new A2 mating type in potato.

Key Theme - Human Nutrition: Family Nutrition Program

Building a healthy diet through nutrition is the backbone of good health. The nutrition education assistants/agents (NEA) motivate clients to adopt eating and lifestyle behaviors that are consistent with the Dietary Guidelines for America and the Food Guide Pyramid. Through the Family Nutrition Program,

staff provides nutrition education by demonstrating ways to incorporate a variety of new foods, and change some of their food preparation methods.

Impact - The variety of delivery methods used in each county reflects programming that relates specifically to the area of dietary quality. This applies to the nutritional value of the food acquired, how the overall diet of the recipient compares to standardized models such as the food guide pyramid and dietary guidelines. Evaluations show:

- 76 percent moved closer to the recommended number of servings of the Food Guide Pyramid.
- 40 percent moved closer to recommended levels of physical activity.
- 49 percent moved closer to the Dietary Guidelines recommendations.
- 76 percent improved dietary quality.

Key Theme - Human Nutrition: Food Safety

The Family Nutrition Program focuses on increasing the ability of individuals and families receiving food stamps to make wise use of their food dollars. This is accomplished by providing

classes to low-income resource audiences on nutrition and meal planning; food purchasing, preparation, and safety; and food resource management.

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

- 95 percent indicated they less often let food set out more than two hours
- 98 percent indicated they washed their hands more often before touching food.
- 98 percent indicated they keep raw meat separate from other foods more often.
- 98 percent cook meats and eggs thoroughly more often.
- 98 percent improved food safety practices.

Source of federal funds: Smith-Lever

Scope of Impact: Multi-state Extension. The FNP is a national program.

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 develop menu planning skills and practice their spending plan for one month. Staff were trained in a new curriculum developed by the University of Wisconsin entitled ***Money for Food***.

Classes are often held at a variety of cooperating agencies such as County Social Services, tribal organizations, senior citizen sites, 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:

- 94 percent use a spending plan more often than before their participation in FNP.
- 93 percent use a menu planning process.
- 50 percent shop from a list more often since participating in FNP.
- 91 percent use comparison-shopping techniques such as reading labels, unit pricing, and reading nutrition fact labels.

Source of federal funds: USDA Food Stamp Nutrition Education.

Scope of impact: State Specific

Key Theme - Human Nutrition: Food Security

The goal of food security is to help food stamp recipients have an adequate supply of food throughout the month. Food security issues were incorporated into a variety of educational topics presented by nutrition education agents/assistants (NEAs) at their nutrition education classes. Emphasized themes included increasing knowledge and/or use of food assistance programs provided in their community. Classes were offered at a variety of locations including the tribal commodity warehouses, food pantries, Headstart, county social services, or transitional living facilities.

Impact - Upon completion of FNP programming classes, clients reported:

- 76 percent decreased the frequency of seeking emergency food assistance (food pantry, soup kitchen, etc.).
- 33 percent increased the use of available non-emergency food assistance programs such as WIC, food stamps, school breakfast and school lunch programs.
- 55 percent of respondents indicated they had enough to eat throughout the month.

Source of federal funds: USDA Food Stamp Nutrition Education.

Scope of Impact: State Specific

Key Theme - Food Safety: Improved Food Safety Undergraduate and Graduate Education

NDSU along with the USDA HEP developed a unique educational experience for undergraduates. Four new courses in food safety and a minor program of study in food safety were developed and implemented. In addition, the Great Plains Institute of Food Safety was established. More recently, the institute's educational offerings were expanded to include a major, a 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 underway to expand the impact of NDSU's program, including its undergraduate and graduate offerings, beyond regional borders using dista nce educational modalities. 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 f aculty from widely different backgrounds. New interdepartmental academic programs in food safety have been developed for initial offering beginning June 12, 2002. Nearly 100 former NDSU students expressed interest in the pursuing a PhD in the area, and we anticipate that several students will enroll in this program during the summer. External companies and agencies have expressed substantial interest in direct participation or receipt through distance formats.

Source of federal funds: USDA Challenge Grant and institutional funds

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

Key Theme – Food Quality – Bison meat

NDSU researchers evaluated the vitamin content of the ribeye muscle from grain and grass finished bison. They also compared the shelf-life of bison to that of beef and pork. In addition, strip loins from grass-finished bison and grain-finished bison were fed to a taste panel to evaluate flavor, tenderness, juiciness and overall acceptability. The panelists consistently preferred the grain-finished roasts over the grass-finished meat.

Impact – The work will help set standards for feeding, processing and labeling bison meat and help refine marketing strategies for the developing bison industry. North Dakota is home to the largest bison processing facility in the world as well as a significant portion of the North American bison herd.

Source of federal funds: Hatch

Scope of impact: Multistate research

Key Theme: Food Quality – Antioxidants from potato peels

Researchers found that freeze-dried water-soluble extract from potato peel contains phenolic compounds that perform as antioxidants in sunflower oil. The extract decreases oxidative deterioration and increases the shelf life of foods such as pastries, sugar cookies and salad dressing. Vitamin E, another antioxidant, prevents color deterioration that occurs in some meat over time; however, it is prohibitively expensive. Synthetic antioxidants are being scrutinized for toxicity. The potato peel extract, however, may be a less expensive, safer alternative. Preliminary research indicates the extract can extend the shelf life of meat products.

Impact: In preliminary research, the addition of potato peel extract extended the shelf-life and color of meat by up to four days, a significant improvement for meat retailers. If successful, the product may provide additional income to potato producers and processors in North Dakota.

Source of federal funds: Hatch

Scope of impact: Statewide research

Key Theme: Food Quality – Reducing Fusarium Head Blight Impact on Malting Barley

Gushing problems with beer and the presence of mycotoxins are well-documented effects associated with fusarium head blight infection in malting barley. These are key reasons why the disease has had such an impact on barley's acceptance by the malting industry.

Because Fusarium head blight can also have pronounced impact on grain composition and quality, probably from enzymes produced by the disease, researchers are looking at the link between infection and grain quality. Also, researchers are looking at ways to reduce the growth of the fusarium mold and production of toxins during the malting process.

Impact: Identifying links between the spread of disease infection and how quality is affected may help researchers find ways of incorporating resistance into barley varieties. For ex ample, some barley varieties may contain natural inhibitors that keep the disease at bay or limit its effect. The researchers are seeing encouraging results using hot water immersion and electron-beam irradiation. These methods of "pasteurizing" barley s eem to reduce mold infection rates during malting while not harming the germination ability of the barley.

Source of federal funds: Hatch

Scope of impact: Multistate research, MN

Key Theme: Food Quality – Pasta quality

NDSU researchers identified durum lines having weak, strong and very strong gluten to assist wheat breeders developing varieties with targeted gluten strength characteristics. Researchers also studied the effect on gluten strength on the final quality of pasta products and evaluated variables in the wheat milling and pasta processing practices for their influence on pasta quality. In addition, researchers evaluated the quality of the 2001 durum crop by testing 224 samples collected during harvest from Montana and North Dakota.

Impact – Research on checking (crack formation) in dried spaghetti indicated that gluten strength and drying temperature affected the occurrence of checking. Strong gluten or an ultra-high drying cycle can reduce checking, the research showed. The research will also help breeders develop wheat varieties with specialized processing characteristics. The resulting varieties will help producers increase the value of their crops and enter specialty markets. Crop quality evaluations he lp industry groups market durum to domestic and foreign buyers.

Source of funding: Hatch

Scope of impact: Multi-state research, MT

Key Theme: Food Quality – Hard Red Spring Wheat

Researchers identified hard red spring wheats with diverse starch characteristics to broaden the applications for wheat such as frozen dough and Asian noodles. Selected varieties were screened for performance in these products. In addition, researchers studied waxy wheats to determine if adding them to bread products could keep them from going stale.

Impact – The research could lead to new uses for North Dakota's wheat crop. The information will help foreign and domestic buyers as they select wheat with characteristics that best meet their needs. In addition, the work may open specialized markets to the region's wheat producers. Preliminary work with waxy durum wheat indicates the wheat reduces the rate at which bread products become stale, reducing the amount of shortening required – an economical and nutritional benefit.

Source of federal funds: Hatch

Scope of impact: Statewide research

Key Theme: Food Safety – Mycotoxin testing

Mycotoxins, toxins created by fungi, can cause food safety problems. Many crop diseases are caused by fungi and mycotoxins can result. NDSU's Veterinary Toxicology Laboratory analyzes food and feed samples to evaluated mycotoxin content. The laboratory also screens samples for crop breeders who are evaluating varieties for resistance to diseases.

Impact – During 1999-2000, about 11,000 cases were processed by the toxicology lab for mycotoxin screens for livestock producers. The laboratory also provided about 4,400 assays for 13 scientists in seven states. The work of the laboratory helps protect livestock from contaminated feed, helps veteri narians and producers identify clinical problems to mycotoxins, and helps researchers develop crops that are safer and have improved quality. The Veterinary Toxicology Laboratory also acts as a reference laboratory for laboratories in North Dakota, Minnesota, South Dakota and Iowa.

Source of federal funds: Hatch.

Scope of Impact: Multi-state research, IA, MN, SD.

Key Theme: Food Security – Sensors for food quality

NDSU researchers are developing miniaturized portable sensors that can provide quality in formation about food products. Intelligent sensors based on electrical nose technology can evaluate the safety and quality of meat and barley.

Impact – NDSU research with miniature portable sensors will give researchers new tools for studying how food quality deteriorates and what hazards arise during food storage and handling. The food industry may also use the technology to detect changes in food quality and safety. Another application may be to detect spoilage or the development of mycotoxins in stored grain.

Source of federal funds: Hatch

Scope of impact: Statewide research

Key Theme – Food Safety – Sanitizing lettuce

Researchers tested diluted solutions of various household sanitizers (apple cider, vinegar, white vinegar, bleach, hydrogen peroxide and lemon juice) for reducing E. coli and other bacteria on lettuce. Lettuce and other vegetables have been implicated in outbreaks of food poisoning and have been shown to be a source of foodborne pathogens.

Impact – Researchers found that white vinegar was the most effective at reducing E. coli levels and other bacteria. Sensory evaluations showed that lettuce treated with diluted sanitizers were acceptable to consumers. The study may lead to easy-to-use home treatments for lettuce and other produce that may significantly reduce the threat from food-borne pathogens.

Source of federal funds: Hatch

Scope of impact: Statewide research

Allocated Resources

($ x $1,000)		**FY01**
1862 Extension ($)	Smith-Lever	1,036
	State	1,480
	FTE	37
1862 Research ($)	Hatch	615
	State	905
	FTE	18.1

Goal 3: A Healthy, Well-Nourished Population

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

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

North Dakota has some unique health- and nutrition-related concerns, including an increased risk of diabetes. NDSU has developed a range of programs that target those problems.

In addition, researchers are studying functional foods and functional food compounds that could lead to improved nutrition and improved human health. Many of the compounds being studied are found in abundance in the region's crops. Nutricuetical uses for those crops and for compounds made from those crops could expand markets or create specialty markets, generating increased revenue for producers and processors.

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 2000-2001, 12 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.

Participants in the Food and Nutrition Program defined a variety of means to help them effectively manage their limited resources. Surveys show 94 percent use a spending plan more often than before their participation in FNP; 93.7 percent use a menu planning process and 91.8 percent use comparison shopping techniques such as reading labels, unit pricing, and reading nutrition fact labels.

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

Flax-pasta is close to commercialization. Mid-size pasta manufacturers have shown interest in producing a flax-pasta product. Economic benefit has been estimated to be $2.6 million. Consumers would benefit by the availability of nutritionally enhanced pasta.

Key Theme - Human Health: The 5 Plus 5 Program

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

The North Dakota 5 Plus 5 program is an educational campaign designed to encourage participants to eat at least five servings of fruits and vegetables per day and to engage in 30 minutes of moderate physical activity at least five days per week as recommended by health and nutrition experts. The program is led by the North Dakota State University Extension Service, the North Dakota Department of Health and the Healthy Heart Council, which includes representatives from the American Heart Association, the Dairy Council of the Upper Midwest, the North Dakota Beef Commission and healthcare centers, parks and recreation departments, registered dietitians and other agencies across North Dakota.

A pilot 5 plus 5 intervention targeting fifth and sixth grade students was conducted with about 80 students. The program included lessons and skill building activities.

Over 100 adults participated in a six-week 5 plus 5 program using technology as a means to educate participants. Consisting of email messages/lessons, a listserv and chat room discussions with experts, the program also including pre/post testing.

Impact – Among participating fifth grade girls, 69 percent reported they had increased their fruit and vegetable consumption, 86 percent reported they had increased their physical activity and 92 percent reported they had met their goals. Girls reported a 44 percent decrease in screen activities (tv, videos) of three hours or more. Among fifth grade boys, 45 percent reported they had increased their fruit and vegetable consumption, 80 percent felt they had increased their level of physical activity, and 80 perc ent felt they had met their goals. Fifth grade boys reported a 37 percent decrease in screen activities of three hours or more. Among the participating sixth grade girls, 33 percent reported increasing their fruit and vegetable consumption, 50 percent reported they had increased their physical activity and 59 percent reported meeting their goals. A 39 percent decrease in screen activities of three hours or more was reported by sixth grade girls. Among participating sixth grade boys, 57 percent reported they had increased their fruit and vegetable consumption, 64 percent reported increasing their physical activity and 86 percent reported meeting their goals. A 45 percent decrease in screen activities of three hours or more was reported.

In the educational program using technology as a means of delivery, knowledge scores increased by 14 percentage points from pre- to post-survey. On the post-survey, self-reported fruit and vegetable consumption increased from 9.5 percent meeting the 5-a-day recommendation to 42 percent meeting the recommendation. Ninety percent of the participants reported increased fruit and vegetable consumption, 72.5 percent reported increased physical activity, 50 percent reported cooking healthier meals and 23.5 percent reported weight loss.

Source of federal funds: Smith-Lever

Scope of Impact: State specific

Key Theme - Human Nutrition: Family Nutrition Program

Healthful nutritional choices, food security and stretching the food dollar remain focal points of the programming in the Family Nutrition Program, which targets food stamp recipients. Low income families are at particular risk for poor nutrition and malnutrition. They often lack the skills and education to plan nutritionally balanced meals, shop wisely, and prepare meals in a wholesome and safe manner.

Impact - Follow-up evaluation has shown that the participants have increased their knowledge and changed their behavior regarding food spending and food choices.

Source of federal funds - Smith Lever

Scope of impact - Multistate Extension. The FNP is a national program.

Key Theme - Human Nutrition: Food Resource Management

The overall goal of the food resource management program of the Family Nutrition Program is to help clients maximize the use of their limited food resources. Utilizing the food resource management components from the Building a Healthy Diet curriculum developed by Iowa State University, nutrition education assistants/agents for the Family Nutrition Program are delivering programs targeted for limited resource audiences across the state of North Dakota. Classes are often held at variety of cooperating agencies such as county social services, tribal organizations, WIC or Head Start.

Impact - Participants defined a variety of means to help them effectively manage their limited resources. Surveys show:

- 94 percent use a spending plan more often than before their participation in FNP.
- 93.7 percent use a menu planning process.
- 50.5 percent shop from a list more often since participating in FNP.
- 91.8 percent use comparison shopping techniques such as reading labels, unit pricing, and reading nutrition fact labels

Source of federal funds: FNS, USDA, Food Stamp Program

Scope of impact: State specific

Key Theme - Human Nutrition: Food SecurityKey Theme - Human NutritionFood Security

The goal of food security is to help food stamp recipients have an adequate supply of food throughout the month. Food security issues were incorporated into a variety of educational topics presented by nutrition education agents/assistants (NEAs) at their nutrition education classes. Emphasized themes included increasing knowledge and/or use of food assistance programs provided in their community. Classes were offered at a variety of

locations including the tribal commodity warehouses, food pantries, Heads tart, county social services, or transitional living facilities.

Impact - Upon completion of FNP programming, 55 percent of respondents indicated they had enough food to eat throughout the month. In addition, 76.9 percent decreased the frequency with wh ich they used emergency food assistance and 33.6 percent increased their use of available non-emergency food assistance programs including WIC, food stamps, school breakfast, and school lunch.

Source of federal funds: USDA Food Stamp Nutrition Education.

Scope of Impact: State Specific

Key Theme – Nutricueticals: Pasta as a Functional Food

Researchers at the Department of Cereal Science, NDSU, are investigating the development of a functional food using durum wheat and flaxseed. These foods can be used as a part of a dietary regime designed to improve nutrition or prevent disease. Secoisolariciresinol diglycoside (SDG), dietary fiber, and alpha-linolenic acid (ALA) are three nutraceutical compounds in flaxseed. Thus, pasta fortified with ground flax seed has improved nutritional quality.

Success of pasta fortified with ground flaxseed depends on the stability of the nutraceutical compounds during processing, storage, and cooking. Researchers have shown that ALA and SDG are not affected by pasta processing or cooking. ALA and SDG were stable in dry flaxseed-pasta for eight months.

Impact – Flax-pasta is close to commercialization. Mid-size pasta manufacturers have shown interest in producing a flax-pasta product. Economic benefit has been estimated to be $2.6 million. Consumers would benefit by the availability of nutritionally enhanced pasta.

Source of Federal Funds: none

Other Sources of Funding: SBARE; APUC; North Dakota Oilseed Council

Scope of impact: State Specific. (Regional)

Key Theme – Nutricueticals: Boosting CLA

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

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

Source of federal funding: Hatch

Scope of impact: Multi-state research.

Key Theme: Nutricueticals – Functional foods

Agricultural engineers are developing dry mechanical processes that could be used to increase the recovery of secoisolariciresinal diglycoside (SDG), a form of lignin that has been shown to reduce the risk of cancer and heart disease. Researchers were able to about double the amount of SDG recovered from flax seed known to have high levels of SDG.

As an offshoot of research to boost mammary development and lactation development in cattle, researchers are extending their studies into nutritional control of mammary growth and breast cancer development in humans. Just as nutritional strategies can influence productivity in animals, strategies may lead to ways to prevent and treat breast cancer in humans.

Researchers are studying plant compounds that contribute to human health by reducing the risk of diseases such as heart disease and non-insulin dependent diabetes mellitus. One compound, chlorogenic acid (CGA), is found in plants and serves as an antioxidant. Research with rates shows treatments can reduce cholesterol and triglyceride levels by 44 percent and 58 percent, respectively.

Impact – Research into functional foods and functional food compounds could lead to improved nutrition and improved human health. In addition, many of the compounds being studied are found in abundance in the region's

crops. Nutricuetical uses for those crops and for compounds made from those crops could expand markets or create specialty markets, generating increased revenue for producers and processors.

Source of federal funding: Hatch

Scope of impact: Multi-state Research

Allocated Resources

($ x $1,000)		**FY01**
1862 Extension ($)	Smith-Lever	896
	State	1,280
	FTE	32
1862 Research ($)	Hatch	27
	State	40
	FTE	0.8

Goal 4: Greater Harmony Between Agriculture and the Environment

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

The irrigated area in North Dakota is increasing in response to the demand for dependable, high yielding, and high quality crops. The potential exists for 500,000 new acres of irrigated crops with sprinkler methods. High value crops such as potatoes, high quality alfalfa, dry edible beans, carrots, onions, and cabbage offer more potential return to producers, and the increased income would be multiplied throughout the local communities. A key to success will be rotations and systems that are both profitable and environmentally friendly.

NDSU researchers are studying if agricultural residues, which are sometimes sources of pollution, can be used as a medium for growing oyster mushrooms. Residues being tested include sunflower meal, stalks and hulls; sugar beet pulp and fibrous plant material; potato peels; soybean and edible bean meal, hulls and waste materials; and wheat, barley and flax straw. Oyster mushrooms sell for approximately $4.99 /lb fresh and $95 /lb ($2.99 per ½ oz) dried at wholesale prices, while agricultural residues, such as sugar beet pulp, sell for around 6 cents per pound.

Irrigators in North Dakota use NDSU crop water use maps and numerical tables for irrigation scheduling. During June, July, August and September of the 2001 growing season, the crop water use website handled over 48,000 requests for pages. Proper scheduling makes maximum use of water resources while limiting leaching of farm chemicals and crop damage.

Researchers developed simple sensors to determine manure nutrient value at the time that manure is removed from storage system and applied to the land. The systems proved accurate for beef and swine manure but were poor for dairy manure. Adoption of the technology could allow producers to tailor livestock waste applications to crop needs, making manure an economical and environmentally safe source of crop nutrients.

Researchers have identified isolates of ash yellows in North Dakota and found that some of them are more virulent than those found in other regions of the country. Pathologists are working with plant breeders to assess the tolerance of green ash varieties to the disease so that ash trees resistant to the disease can be used for urban landscapes and resource conservation plantings.

Soil scientists' research on the fate and transport of chemicals and bioactive chemicals in soil will lead to more precise studies on how these chemicals move and change in the environment and the effect they may have on plant, animal and human health, such as genetic mutations, reproductive problems, antibiotic resistance and other health problems.

Sheep effectively controlled leafy spurge after one year using a single species grazing approach and after three years using a multi-species grazing approach in NDSU studies. Leafy spurge stem densities were reduced by 96 percent and 92 percent on single-species and multi-species grazing treatments, respectively, after six years. Season-long grazing using a multi-species approach provided a quicker, more efficient grazing of leafy spurge than rotational grazing; however, both reduced leafy spurge stem densities by 94 percent and 82 percent, respectively, after six years. The research provides new options for North Dakota livestock producers who want to control this invasive weed.

Individual counties in North Dakota continue to use flea beetles from their own insectaries to reduce leafy spurge. NDSU research showed the flea beetles could be used to control the weed Data indicate these insects may have an annual impact of $58 million by 2005.

Key Theme - Water Quality: Nutrient Management

Extension specialists and Experiment Station researchers developed approaches that make site-specific fertilization feasible for a variety of crops in different physiographic settings. These techniques reduce over-application of nitrogen (N) where residual N is high at the end of the growing season and in areas where leaching potential is high. Sugar beet growers in the Red River Valley manage about 100,000 acres using satellite imagery and aerial photography to map areas of homogeneous N uptake within sugar beet fields and then give an N credit or adjustment for subsequent crops. Wheat and sunflower growers in central and western North Dakota are using topography, aerial imagery and electrical conductivity detectors to lo cate 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 2001, programs focusing on site-specific management totaled about 1,000 attendees at various presentations around North Dakota. In addition, site-specific soil testing has been woven into nearly all presentations given, amounting to about 2,000 other attendees. News releases on radio and in the press have been provided for people who do not attend meetings. Four circulars were printed in 1999 to provide general site-specific information regarding sampling, fertility, concepts and environmental benefit s. 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 2001. In studies using zone management of N in sugar beets, economic advantages when there is sufficient variability of N range from $10-100/acre. On wheat and sunflowers, net returns are in the range of $5-15/acre, which would roughly double profit margi ns in these crops. In addition, the use of some form of zone N sampling reduces the need for "insurance" rates of N, which are often 40-50 lb N/acre ($6-15/acre current price). There is the intangible benefit of reduction in nitrate leaching due to bette r N utilization by crops and reduction in over-fertilization of "leaky" areas of the field.

Source of federal funds: Smith-Lever and Hatch

Scope of Impact: Multi-state research and extension. MN and SD

Key Theme – Recycling: Use of Agricultural Residues for the Production of Oyster Mushrooms

Oyster mushrooms can be a value-added crop, utilizing agricultural byproducts as substrates. Different substrates are being evaluated for effects on oyster mushroom yield, quality attributes, nutrient differences and usability of the spent substrates after mushroom harvest. Substrates tested (based on preliminary screening) have included wheat straw, sugar beet pulp and soybean hulls with or without supplementation with corn gluten and buffers (calcium carbonate and calcium sulfate). Oyster mushroom yield appears to be highest on substrates such as soybean hulls and sugar beet pulp with nitrogen supplementa tion from corn gluten and pH buffering. Researchers will determine optimal substrate composition for oyster mushroom production using agricultural residues and evaluate if substrate composition affects sensory and nutritional qualities of oyster mushrooms . They'll also study spent substrate from oyster mushroom production to see if it can be used for animal feed and to determine if it contains commercially useful enzymes.

Impact – Many agricultural residues, which traditionally have limited uses, can b e converted to value-added products such as mushrooms. The oyster mushroom (*Pleurotus* spp.) is an ideal type of mushroom for such a purpose because it can easily be grown on many types of lignocellulosic materials and has highly prized culinary and health benefits. Examples of North Dakota agricultural residues which have potential as mushroom substrates are sunflower meal, stalks and hulls; sugar beet pulp and fibrous plant material; potato peels; soybean and edible bean meal, hulls and waste materials; and wheat, barley and flax straw. Farmers could expand the productivity

and profitability of their crops by producing secondary products, such as oyster mushrooms. The mushroom grower might utilize the spent oyster mushroom substrates as protein-enriched animal feed. The mycelial mat left after mushroom harvest may also contain commercially useful enzymes. Currently, oyster mushrooms sell for approximately $4.99/lb fresh and $95.00/lb ($2.99 per ½ oz) dried at wholesale prices, while agricultural residues such as sugar beet pulp sell for around 6 cents per pound.

Key Theme - Water Quality: Irrigation Technical Information and Assistance

Effective irrigation water management requires accurate daily crop water use estimates. In1995, the Extension specialist and an applications programmer developed a website 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 59 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 crop water use 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 the website.

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 2001growing season, the crop water use website handled over 48,000 successful requests for pages. The average daily requests were over 450 with Monday being the busiest day with a total of more than18,000 requests. The website was accessed the most in August (over 16,000 requests), which is not surprising since it was the hottest and driest month. Over 800 distinct computers accessed the website. The crop water use numerical tables were requested about 10 times more often than the crop water use maps. There are about 1,500 irrigators in North Dakota. Many contract with crop consultants for information services. Most consultants that work with irrigators access the website at least twice per week and increase the impact of the irrigation water management information by providing a multiplier effect.

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension.

Key Theme: Agricultural Waste Management – Testing Nutrient Values.

Manure production by about 2 million cattle and 250,000 swine in North Dakota impacts water quality; improving manure management is essential. Generally producers cannot determine manure nutrient values in a timely manner, as it is not practical for them to collect and get a representative manure sample before land application. Applying

too much could lead to contamination of surface and subsurface water. Not applying enough manure is an inefficient use of a nutrient-rich resource.

Impact – Researchers developed simple sensors to determine manure nutrient value at the time that manure is removed from storage and applied to the land. The sensors proved accurate for beef and swine manure but were poor for dairy manure. Adoption of the technology could allow producers to tailor livestock waste applications to crop needs, making manure an economical and environmentally safe source of crop nutrients.

Source of federal funding: Hatch

Scope of impact: Statewide research

Key Theme: Forest Crops – Ash Yellows

Green ash is the most important tree species in North Dakota. Consequently, researchers have been studying a disease called ash yellows for nearly a decade. Because of the prevalence of green ash in the state, the disease has the potential to have more of an impact than Dutch elm disease.

Impact – Researchers have identified isolates of ash yellows in North Dakota and found that some of them are more virulent than those found in other regions of the country. Pathologists are working with plant breeders to assess the tolerance of green ash varieties to the disease so that ash trees that are resistant to the disease can be used for urban landscapes and resource conservation plantings.

Source of federal funding: MacIntire-Stennis, Hatch

Scope of impact: Statewide research

Key Theme: Forest Crops – Disease resistant trees

Harsh northern environmental conditions allow a limited number of trees to adapt to the region. Tree breeders must select and introduce new tree species to the region to further improve trees that are adapted to cold environmental conditions. The process of developing trees that are adapted to both cold weather and resistant to the region's pests and diseases is long and difficult. Researchers are using genetic transformations to adapt trees by introducing disease resistance genes into American elm, herbicide resistance genes into Siberian elm, and improved rooting genes into aspen.

Impact: Success of the research will lead to a broader selection of trees that are better able to tolerate the climate and pests of the region. In addition, the aspen with improved rooting characteristics will allow them to be propagated more economically, possibly allowing them to be used as an energy crop.

Source of federal funding: MacIntire-Stennis, Hatch

Scope of impact: Statewide research

Key Theme: Hazardous Materials – Transport of materials through soil.

Water flow and chemical transport properties of field soil influence crop nutrient and pesticide loss. These properties also influence the transport of other possible environmental pollutants such as antibiotics and industrial solvents. NDSU soil scientists studied these processes with chemical tracers to learn more about areas prone to loss of agricultural and industrial chemicals. Researchers have also studied the fate and transport of bioactive chemicals through soils. These chemicals include estradiol, testosterone, brominated flame retardant and sulfa - based antibiotics. The chemicals may be present in ani mal manures that are applied directly to soils and can potentially contaminate surface and subsurface water resources.

Impact: Research on the fate and transport of chemicals and bioactive chemicals in soil will lead to more precise studies on how these chemicals move and change in the environment and the affect they may have on plant, animal and human health, such as genetic mutations, reproductive problems, antibiotic resistance and other health problems.

Source of federal funding: Hatch

Scope of impact: Multi-state research

Key Theme: Integrated Pest Management – Leafy spurge control

NDSU specialists are working to help producers and land managers control leafy spurge, an invasive weed that infests rangeland and drastically reduces its value for gr azing. One project uses sheep and cattle grazing together to control the weed, because sheep will graze the weed while cattle will not. In addition, NDSU entomologists evaluate insect pests of the weed and have identified insects that have been released widely across the region in a

biocontrol effort against leafy spurge. Additional research focuses on identifying grasses and other plants that can compete with leafy spurge and recommending chemical control strategies.

Impact – Sheep effectively controlled leafy spurge after one year using a single-species grazing approach and after three years using a multi-species grazing approach. Leafy spurge stem densities were reduced by 96 percent and 92 percent on single-species and multi-species grazing treatments, respectively, after six years. Season-long grazing using a multi-species approach provided a quicker, more efficient grazing of leafy spurge than rotational grazing; however, both reduced leafy spurge stem densities by 94 percent and 82 percent, respectively, after six years. The research provides new options for North Dakota livestock producers who want to control this invasive weed.

Individual counties in North Dakota continue to use flea beetles from their own insectaries to reduce leafy spurge. Data indicate these insects may have an annual impact of $58 million by 2005. n some areas.

NDSU weed scientists showed that an additional herbicide could be used on leafy spurge infestations. Because of NDSU research, the EPA granted a label for that use and producers now have an additional tool to use in areas where other control methods do not work and during times of the year when other herbicides are not effective.

Source of federal funding: Hatch and Smith-Lever

Scope of impact: Multi-state research and extension

Key Theme – Nutrient Management – NDSU Soil Testing Laboratory

From 1999 to 2000, the NDSU Soil Testing Laboratory processed nearly 25,000 soil samples for farmers, ag 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.

Source of funding: Hatch

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

Key Theme: Recycling – Fly Ash for Feedlots

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

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

Source of federal funding: Smith-Lever and Hatch

Scope of impact: State specific.

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

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

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

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

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

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

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

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

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

Source of federal funds: Smith-Lever and EPA

Scope of Impact: State Specific

Allocated Resources

($ x $1,000)		**FY01**
1862 Extension ($)	Smith-Lever	224
	State	320
	FTE	8

1862 Research ($)	Hatch		136
	State		200
		FTE	4

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

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

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

At the same time, the state's youth need opportunities to be meaningfully involved in family, school, and community in order to develop skills and confidence to become productive, caring adults who contribute positively to society. Experiential learning in areas relating to healthy

lifestyles, preparing for careers, developing communication, social skills, leadership and community involvement can provide the education and development of these life skills.

More than 533 teachers and other adults in North Dakota communities were trained to use the CHARACTER COUNTS! curriculum directly with youth in North Dakota in 2001. This included educators from 36 school districts. Based on past experience with the program, it is estimated that those trained through the grant worked or will work with at least 13,325 youth within six months of completing the training. The majority of the participants are teachers who will continue to work with additional youth in

the program for at least three years, increasing the initial estimate of the number of youth reached and reinforcing the principles taught in the curriculum.

Value-added research and demonstration efforts in western North Dakota are showing dramatic results. Anheuser Busch, Cargill and Coors have implemented a malting barley increase program. Acreage of selected varieties of malting barley under contract has gone from zero acres in 1998 to over 30,000 acres in 2001. The three companies would like to contract 50,000 to 100,000 acres of malting barley in the near future. In addition, 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. 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. Finally, 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.) new processing facilities have developed. In the region, there was one processor in 1995; now there are four.

More than 40 teens and adults have participated in GPS/GIS training programs, and community projects have included helping a city forester map mosquito breeding areas for more targeted chemical application, having teens teach farmers at an annual pesticide update how GPS works, and using a GPS challenge activity as a Friday night fun alternative activity for teens in one small rural community to teach other teens about GPS and to address the need for positive youth development activities within their community.

An easy-to-use spreadsheet has been developed by NDSU researchers to help new generation cooperatives monitor their financial status and evaluate risk. It will be used by cooperatives throughout the Great Plains to assist with financial decision making. Explicitly incorporating risk into the spreadsheet helps directors and managers examine scenarios to limit downside risk, inherently protecting the farmer/owner equity position.

Key Theme - Character/Ethics Education: Character Counts

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

State, federal, local and grant sources of funding have enabled North Dakota to offer CHARACTER COUNTS! in communities and in 4-H youth activities throughout the state. Volunteers, county extension staff (state and local) along with school administrators, teachers, and community members have been part of the training and implementation of the program in local communities.

Leaders and teachers are trained in the curriculum and then are able to teach the curriculum and activities to others. It makes use of traditional extension face-to-face training with leaders and then exponentially expands as each leader trains more people. Educational materials on character including extension publications and newsletters promote and explain character education. It has been incorporated into activities at county and state fairs as well. In addition television, radio, and newspapers have also picked up on the need to educate for character. Many schools have requested this character education program after going through school improvement processes and have come to the extension service for assistance in this area.

Impact - More than 533 teachers and other adults in North Dakota Communities were trained to use the CHARACTER COUNTS! curriculum directly with youth in North Dakota in 2001. This included educators from 36 school districts. Based on past experience with the program, it is estimated that those trained through the grant worked or will work with at least 13,325 youth within six months of comple ting the training. The majority of the participants are teachers who will continue to work with additional youth in the program for at least three years increasing the initial estimate of the number of youth reached and reinforcing the principles taught in the curriculum.

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An evaluation plan to measure the effectiveness of CHARACTER COUNTS! in North Dakota was initiated in 2001. Student and teacher survey instruments were adapted to the needs of North Dakota from the South Dakota State University Cooperative Extension Service/4-H Evaluation. During spring of 2001 the first student and teacher surveys were administered to establish a baseline to compare future surveys. The data from the surveys will help draw conclusions about the behavioral changes occurring as a result of this program. The findings cannot be used to make definite statements about the program's effectiveness. They are designed as baselines against which future measurements can be compared.

Seven schools in seven counties were invited to participate in the teacher surveys. One hundred fifty surveys were returned from teachers in grades 1-12. Impact measures from these surveys give us a window into the teacher perceptions of how the program is working. The teachers believe that although they cannot say that students fight

less often they do help each other more and call each other names less. In grades 1-6 the majority of teachers feel their students are less destructive of property and treat the teacher with more respect. Since not as much time is spent in grades 7-12 on CHARACTER COUNTS! the numbers are lower in the same categories. The majority of teachers in grades 1-6 feel that their students play by the rules more often and have better recess behavior. In grades 7-12, 15 percent of teachers feel that their students cheat less, 12 percent get their homework done more often and 7 percent have better manners.

Teachers in grades 1-6 perceive that their students are receptive to the program, that fellow teachers are supportive and that parents are supportive. In grades 7-12 teachers perceive that 35 percent of students are receptive to the program, 29 percent of the teachers are supportive of the program and 23 percent of the parents are supportive of the program. Both groups perceived the community as lacking in support of this program. Most teachers are not sure that this program reaches children who really need it. The majority in all grades feels that the curriculum is age appropriate. Forty-one percent of teachers in grades 1-6 believe that CHARACTER COUNTS! makes a difference in the lives of their students while only 14 percent in grades 7-12 believe this. Forty-nine percent of teachers in grades 1-6 believe that CHARACTER COUNTS! will have a long term impact on their communities while only 21 percent believed that in grades 7-12.

Two teachers summed up the whole process. One said "I think it is an excellent program but it is way to soon to be looking for permanent changes! I think tho se who started these activities at a younger age and continue them will gain more than most senior high students." Another teacher said "It takes time to make changes in our lives."

Source of federal funds: Smith-Lever

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

Key Theme - Community Development: Value Added Agriculture Education

This effort focuses on three phases of value-added agriculture development. The first is to assist producers and industry 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 - Five events aimed at educating the public on the strengths and iden tified opportunities for the region were held during the year. Interest in value-added agriculture was high as over 75 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 cabbage were singled out). The second was developing niche crops to be used in rotation with high value crops (malting barley, soybeans and identity-preserved wheat were identified). The third was attracting food-processing firms for better markets (an effort is underway to attract a French fry plant to the region). 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, Anheuser Busch, Cargill and Coors have implemented a malting barley increase program. Acreage of selected varieties of malting barley under contract has gone from zero acres in 1998 to over 30,000 acres in 2001. The three companies would like to contract 50,000 to 100,000 acres of malting barley in the near future. 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 foll owing 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 are 4 processing facilities.

On the livestock side, two dairies are currently working on equity drives and hopefully will be in production in 2003. An alfalfa cubing and press facility is in the works and will utilize 75,000 tons of alfalfa in the region. 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 may be marketing opportunities overseas, for example in Japan.

Source of federal funds: Smith-Lever

Scope of Impact: Multi-state Integrated Research and Extension in ND and MT.

Key Theme: Workforce Preparation – Youth GIS/GPS Training

Extension specialists from the center for 4-H and agricultural engineering have teamed with county extension agents to create 4-H GIS/GPS leadership camps for teens in North Dakota. The program is designed to teach

teams of teens and adult mentors GIS and G.P.S. skills in data collection and mapping for use in areas of need back in their local communities.

Impact – More than 40 teens and adults have participated in this training program. Community projects have included helping a city forester map mosquito breeding areas for more targeted chemical application, having teens teach farmers at an annual pesticide update how GPS works and using a GPS challenge activity as a Friday night fun alternative activity for teens in one small rural community to teach other teens about GPS and to address the need for positive youth development activities within their community. In addition, Nor th Dakota 4-H has two traveling GPS educational trunks, each containing 10 GPS units, educational activities and supplies for carrying out GPS training activities.

Source of federal funds: Smith-Lever

Scope of impact: Statewide extension

Key Theme – Community Development – Impacts of Agriculture Processing Plants on Rural Communities

The impacts of agriculture processing plants on rural communities were evaluated by researchers through data collected from community leaders, company officials, and a rea residents in four North Dakota towns that are the sites of new agricultural processing facilities developed during the 1990s. Study results indicated that improved job opportunities and enhanced incomes were generally seen as major positive effects of the new processing plants. Because most of the plant jobs were taken by persons already living in the area, the new plants did not lead to substantial in-migration or major population growth, but served to stabilize the local economy and population. Of all the effects, only air quality and water quality were more often rated as negative than positive by local residents, but interviews indicated that even these effects were not major concerns.

Impact – Communities, business planners and policy makers will use the research to plan for new business development and anticipate effects of that development.

Source of federal funds: Hatch

Scope of impact: Statewide research

Key Theme: Community Development – Improved Management for Value-Added Communities

Value-added cooperatives in the Northern Plains have had major financial difficulties for a variety of reasons, including marketing, production line difficulties, financial and equity management and under capitalization. NDSU researchers developed a management tool for new generation cooperatives that features a user-friendly spreadsheet that tracks cooperative financial status and incorporates risk into financial projections.

Impact – Interest in the new spreadsheet has been broad and it will be used by cooperatives throughout the Great Plains to assist with financial decision making. Explicitly incorporating risk into the spreadsheet helps directors and managers examine scenarios to limit downside risk, inherently protecting the farmer/owner equity position.

Source of federal funds: Hatch

Scope of impact: Multi-state research.

Allocated Resources

($ x $1,000)		**FY01**
1862 Extension ($)	Smith-Lever	490
	State	700
	FTE	17.5
1862 Research ($)	Hatch	30.6
	State	45
	FTE	0.9

B. STAKEHOLDER INPUT PROCESS

Various processes for stakeholder input are utilized on an on-going basis. This input is used to shape our long range plan of work along with adjustments to our annual activities. North Dakota research and extension also maintains strong relationships with state and county government officials. State legislators and county commissioners actively participate in meetings and workshops and provide feedback directly to individual faculty and administrators. These processes assure that high priority issues facing the people of North Dakota are addressed and that programs are directly supported by North Dakota citizens. Examples of stakeholder input processes undertaken are as follows:

State Board For Agricultural Research and Education (SBARE)

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

Multicounty Program Unit (MPU) Advisory Committees

Ten MPU advisory committees each met at least twice during the past fiscal year, once in the spring and again in the fall. The spring meetings dealt with issues and needs identification while the fall meetings were dedicated to program review. This input is utilized by extension agents to develop local programs and to set direction for the State Extension Plan of Work. Many MPU advisory committee members work directly with their local extension agent on program development. MPU advisory committee members are nominated by their local county.

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.

Family Life Education Committee

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

C. PROGRAM REVIEW PROCESS

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

D. EVALUATION OF THE SUCCESS OF MULTI AND JOINT ACTIVITIES

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

Great Plains States Collaboration

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

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

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

Tri-state Corn Work

North Dakota, Minnesota and South Dakota continue to cooperate in planning and delivering extension educational efforts on corn production and utilization. Educational efforts continue to be multi-county/multi-state workshops, field tours and mass media work that emphasizes production management practices and marketing. Corn production continues to grow in the three states due to market opportunities, excellent yields and adoption of agronomic practices that have made corn a competitive and viable crop in the three-state area.

Northern Plains Sustainable Agriculture Society and Organic Agriculture

The Northern Plains Sustainable Agriculture society (NPSAS) contains members from North Dakota, South Dakota, Montana, Nebraska, Minnesota and Canada. The group's goal is to promote sustainable food production systems in agriculture. While many of the members are organic producers, it welcomes all those interested in producing food in sustainable systems. A North Dakota Extension agent continues to chair this group, with the majority of the members coming from North and South Dakota. NDSU Extension Service staff have been active in developing educational programs for NPSAS. More than five years ago NDSU extension was instrumental in developing the beginning orga nic 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 producti on 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 numb er of contacts from organic farmers, consumers, university personnel and federal agencies looking for advice on organic farming and the organic industry. Current work is focused on facilitating a dialogue on the coexistence of GMO, non-GMO and organic crop production.

EWEASK Regional Sheep CD ROM

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

Advanced Crop Advisers Workshop

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

Commercial Vegetable Growers of North Dakota meets Researchers

The CVG of ND recently set up a meeting with new vegetable growers in North Dakota to meet with researchers from around the state and out of state. Researchers from Sidney, Mont., 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 being 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 will be 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.

North Dakota State University Extension Service works to set up food processor association in North Dakota

The NDSU Extension Service has worked with the manager of a local potato processing facility and an economic developer to start a processor association. There is no history of processing associations in North Dakota, and with the potential for farmers and processors to be working together, the new group brings a lot to the table. Interdependence and the information age of agriculture are new buzz words but even more than that, they mean strength in business. The Greater North Dakota Association has also been added as a catalyst to make the association work efficiently. The North Dakota Food Processors Association (NDFPA) is working to look at transportation, purchasing, marketing, partnering and other ways to operate more effectively. NDFPA is also publishing a newsletter called "PROCESS THIS."

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 would use 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. This

is being made possible by having two states working together and sharing inputs for the analysis and launching of a new industry.

Multi State Onion Research Project

Minnesota, Montana and North Dakota extension and research staff worked together in 2000 to extend the capacity for vegetable production and marketing in the region. A North Dakota specialist and a Minnesota extension agent along with a researcher from Sidney, Mont., coordinated efforts with an Idaho seed company to identify onion varieties that will do well in the region. The company is interested in the region because vegetable production is being driven out of the existing production areas by production cost, population expansion, and regulation. Test plots were planted in 2000 and 2001 at Sidney, Mont.; Oakes, N.D.; Carrington, N.D.; and Staples, Minn. The test plot results were compiled and assembled for the seed company to further select varieties. The project has meant sharing of labor, talent and information to move toward a new production of a high-value crop to replace low valued commodities.

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

Efforts to educate producers, industry, government, and financial clientele in both North Dakota and Montana are the focus of this value-added agriculture program. This effort focuses on three phases of value added agriculture development: (1) to assist producers and industry identify the strengths and opportunities in the region; (2) to educate clients on constraints and requirements to develop a value-added ventures; and (3) to serve as a resource for implementing identified value added-agriculture opportunities.

Five events aimed at educating the public on the strengths and identified opportunities for the region were held. Over 75 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, carrots and onions were singled out). The second was developing niche crops to be used in rotation with high value crops (malting barley and identity preserved wheat were identified). The third was attracting food-processing firms for better markets (an effort is underway to attract a French fry plant to the region). The final area of identified opportunity was the development of higher value dry land crops (chickpeas and other legumes 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, Anheuser Busch, Cargill and Coors have implemented a malting barley increase program. Acreage of selected varieties of malting barley under contract has gone from zero acres in 1998 to over 30,000 acres in 2001. The three companies would like to contract 50,000 to 100,000 acres of malting barley in the near future. 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 are 4 processing facilities.

As value-added efforts such as the ventures described above are implemented, providing adequate resources and good information is critical to further developing these ventures. Detailed economic data on these projects were provided to producers interested in becoming involved with value-added agriculture. As a result, more producers are becoming involved, more acres of higher value crops are being produced, and producers are adding wealth to their bottom lines.

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 though the season and the final results. It also allowed the cooperative project to be produced through both universities and the non-profit Ducks Unlimited organization.

Multi-state Crop Program and the Crops Teleconference for ND and MN

A cooperative project involving agronomy information sharing across the Red River Valley was begun in 1999 and continued through 2000 and into 2001. Cropping information on corn, soybeans and canola was shared across state lines in North Dakota, Minnesota and into South Dakota. Both hard copy and electronic cropping information was provided in the form of bulletins, brochures, crop newsletters, posters, PowerPoint programs, DTN articles, news releases and through list serves such as AgDakota. A Web site is maintained for county agents within the Red River Valley from both North Dakota and Minnesota and cropping concerns and information were disseminated through a weekly, interactive teleconference forum for discussing crop diseases, insects, and weed concerns as well as crop progress. This forum allowed the county agents to request specific specialists and in-depth information on problems that were encountered in the counties. Also, the discussions that followed allowed the county agents to provide information to fellow agents and also established a platform for standardizing information given out at the county level, specifically on technical requests such as crop insurance requirements and the county agents' roles in answering questions and providing assistance with these programs. Agents from both states have emphasized the timely help that has come from this crops teleconference forum.

Teamwork Reaps Sweet Success for Sugar Beet Producers

Sugar beet growers in North Dakota and Minnesota produce 50 percent of United States beet sugar. The total business activity of the sugar beet industry in North Dakota and Minnesota was estimated at $2.3 billion in 1997. Cercospora leaf spot is the most serious leaf disease of sugar beet in North Dakota and Minnesota. This disease causes reductions in tonnage and sucrose, increases impurities, and roots of diseased plants do not store well in sugar beet piles. In 1998, sugar beet growers in North Dakota and Minnesota lost $75 million because of Cercospora leaf spot, despite spending $38 million in fungicide applications.

Action and Recommendation

Researchers from North Dakota State University and the Northwest Research Outreach Center, University of Minnesota - Crookston, and researchers from the Southern Minnesota Beet Sugar Cooperative conducted studies to determine control and management strategies for Cercospora leaf spot. These studies contributed to the fungicide Eminent being granted a section 18 label for controlling Cercospora leaf spot in North Dakota and Minnesota in 1999, 2000, 2001, and 2002. Extension specialists recommended that sugar beet growers rotate Eminent with fungicides having different modes of action for Cercospora leaf spot control and management of fungicide resistance. Our research also shows that another fungicide, Head line (a strobilurin), also is very effective at controlling Cercospora leaf spot. It is anticipated that this new product will have a full label in 2002 so that growers would have effective fungicides from different classes to control Cercospora, and by rotating different classes, manage fungicide resistance.

Impact

Cercospora leaf spot severity in sugar beet was very high in 1999, moderate in 2000, and low in 2001. Growers had excellent field control using Eminent and other fungicides in alternation. Ninety-seven percent and 94 percent of growers surveyed in 1999 and 2000, respectively, indicated that they rotated the use of Eminent. The percentage of sugar beet growers who stated that Cercospora leaf spot was their worst production problem dropped from 36 percent in 1998 to 6 percent in 1999, 3 percent in 2000, and 1 percent in 2001.

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

Institution **NDSU**
State **North Dakota**

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

	Actual Expenditures
Title of Planned Program/Activity	**FY 2001**
Sugar Beet Program	48,909
Agronomy Program	8,840
Value Added Programs	31,206
TOTAL:	88,955

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F. INTEGRATED RESEARCH AND EXTENSION ACTIVITIES

Renewable Resources

EDUCATION:

* **A 12-month grazing and forage planning workshop (two - and three-day)**: Four intensive grazing and forage sessions were held in North Dakota for livestock producers. Ranchers learned to improve their rangeland management skills and develop year-long forage use strategies. There were 84 ranchers participating in this program. Roughly 47 percent of the ranchers were beginners in developing new grazing strategies while the remaining individuals looked to further improve their current grazing and forage programs. These four workshops impacted almost 116,000 acres of native rangeland, pastureland, and hayland. Over 75 percent of the participants were planning to add new range improvement practices, and over 90 percent planned to implement the training strategies learned in the workshops. Two employees of the US Forest Service and the Commissioner of the North Dakota Game and Fish Department participated in the program. These three individuals response to the workshop included trying to incorporate new strategies on a potential 1 to 2 million acres of public lands.

* **Trace and macro mineral management workshops**: Four workshops were conducted in western North Dakota for livestock producers. Ranchers learned mineral needs for livestock, mineral status on rangeland and pastureland, and balancing mineral needs to improve management skills of the grazing livestock animal and became proactive in maintaining and understanding a well-balanced mineral program. These workshops were designed to teach livestock producers potential problems in mineral deficiencies and how to balance a supplement program to improve livestock health. Over 150 ranchers participated in these workshops, having a direct impact on the health and production potential of an estimated 30,000 head of livestock.

***Educating youth on the importance of the range resource**: A four-day range youth camp was conducted in western North Dakota for youth interested in the range resource and range judging. Youth learned the importance of range to livestock producers, the environment community, and wildlife enthusiasts. They learned basic fundamental range management practices and how to judge the resource for health and value for forage and wildlife habitat. Over 40 youth ages 13-18 participated in the four-day camp and over 140 participated in the State Range Judging Contest. We believe any involvement of youth in the importance of the range resource and fundamental needs for managing these lands will create a more well-rounded adult.

RESEARCH:

***Nutritional composition and mineral status on native rangeland and introduced grass plants**: The NDSU Extension Service in cooperation with the Animal and Range Sciences Department and Hettinger Research Extension Center has conducted three nutritional stu dies in western and south central North

Dakota. This research has recognized nutritional composition and mineral status of 36 different grass varieties (20 cool-season and 16 warm-season grasses). These results will allow forage growers, livestock producers, and wildlife managers to select one or more grasses that fit their needs and goals to provide a more economically efficient operation. They can select a grass that fits a specific program and problem area. Example: if a livestock producers need to add spring and fall pastures and a summer haying field, they can select a grass that fits each specific need while providing nutrients and forage at optimal levels (meadow brome 'Regar' for spring, switchgrass 'Forestburg' for summer hay ground, Russian wil drye 'Mankota' for fall use while complementing the native pasture for summer grazing). Mineral status was also determined for native prairie with overwhelming results showing copper deficiencies during the entire growing season, zinc deficiencies in many years after mid July, phosphorus deficiencies by early July on all rangelands except lowlands associated with adjacent uplands, and potassium deficiencies after mid September. We also know calcium and iron are adequate during the entire growing season, a nd potassium high until mid September.

***Effects of sheep grazing using a multi-species and single-species grazing approach on leafy spurge infested rangeland**: NDSU Extension Service, in cooperation with the Animal and Range Sciences Department and Hettinger Research Extension Center, conducted grazing trials on leafy spurge infested rangeland throughout North Dakota. Sheep effectively controlled leafy spurge after one year using a single species grazing approach and after three years using a multi-species grazing approach. Leafy spurge stem densities were reduced by 94 percent and 82 percent on single-species and multi-species grazing treatments, respectively, after five 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 92 percent and 32 percent, respectively, after five years.

Entomology Research and Education

Small Grains - A regional survey for estimating wheat midge overwintering populations was completed for the sixth 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.

Cooperative studies evaluating wheat host plant resistance to wheat midge continues between experiment station and extension programs. Locally developed HRS and durum germplasm is being screened for wheat midge resistance following similar procedures developed earlier in a resistance study that focused on durum wheats. Resistant Canadian germplasm is being evaluated and compared to North Dakota germpl asm. NDSU wheat breeders are using the
Canadian germplasm for development of midge-resistant wheats.

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 d iseases.

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 a ctivities 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. There is greater confidence in the treatment decision tools developed for bivoltine borers being applicable to the region as a result of this study.

Oil Seed crops - Sunflowers have a unique set of insect pest problems. In general, the key insect pests feed almost exclusively on sunflower. A region-wide survey of sunflower fields was conducted in September. The survey, sponsored by the National Sunflower Association, surveyed fields to estimate yield, classify production practices, and identify and rate weed, disease, and insect problems. Using the georeferenced data, insect pest problems and their area of concentration were illustrated across North and South Dakota as an educational tool for emphasizing key pest issues for the coming year. The Lygus bug, a plant bug that has severely impacted confectionary sunflowe r 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 docum ent the impact and incidence of this and other insect pests.

Oil Seed crops - Soybeans were surveyed during the growing season for the presence of soybean aphid, Aphis glycines, a new insect pest found in the U.S. North Dakota did not have any indication of aphids present in the fall of 2000. Aphids were found in August 2001. By the end of the growing season, aphids were detected in most North Dakota counties bordering Minnesota and several counties farther west. Research proposals were submitted and funde d for future studies emphasizing the aphid's life history, host plant resistance screening, and pest management decision making.

Oil Seed crops - Canola management studies focusing on the crucifer flea beetle are being coordinated by an 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. Late summer surveys are being planned.

Regional Pest Management Centers - In the first year of a three year project, a statewide pesticide use survey was coordinated with NDSU Extension Service, the North Dakota Agricultural Statistics Service, and North Dakota Department of Agriculture. The final report will be published in 2002.

North Dakota Crop and Pest Report - The newsletter is coordinated through the entomology office. Responsibilities include subscriber database, final editing, distribution, and web page p ublishing. 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 region al 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 sit e 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 thistle caterpillar management in regional crops, alfalfa webworm management in forages and soybean, variegated cutworm impacting field crops and vegetable gardens, forest tent
caterpillar management during outbreaks, soybean aphid watch, and others.
(http://www.ag.ndsu.nodak.edu/aginfo/entomology/entupdates/index.htm).

Integrated Beef Research Extension Activities

North Dakota beef producers have access to a number of grain processing byproducts. About 1000 tons of wheat middlings are produced in the state every day. Wheat middlings are used by the feed industry as base ingredients for supplements, creep feeds, and other products. While many ranch operators would prefer to use these types of byproducts, many are hesitant to switch from traditional feedstuffs until more research data is available. Another factor which influences their decisions is labor concerns. Average age of ranchers in the state is increasing and average number of cows per ranch is increasing as well. This has increased the need for labor saving methods of production. Typically in beef backgrounding operations, rations are either hand fed (labor intensive) or fed with tractors and mixer wagons (capital intensive). Our integrated beef research extension program has investigated the use of wheat middlings as a self fed ration for backgrounding cattle and reported the results back to producers.

Two years of research data with backgrounding heifers indicates that wheat middlings can be successfully self fed with minimal proble ms. Performance measurements (weight gain, feed conversions, and intakes) are similar for cattle fed total mixed rations containing wheat middlings or similar diets fed in self feeders. A number of ranchers across the state have adopted this technology. Anecdotal evidence indicates that the method saves labor and reduces equipment costs associated with backgrounding cattle. More flour milling and pasta plants continue to be developed in the state, so wheat middlings will become even more available to the state's beef cattle producers.

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

Title of Planned Program/Activity	**Actual Expenditures FY 2001**
Renewable Resources	8,480
Beet Education	19,075
Entomology Education	10,508
TOTAL:	38,063

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

Title of Planned Program/Activity	**Actual Expenditures FY 2001**
Renewable Resources	3,229
Beet Education	4,363
Entomology Education	1,385
TOTAL:	8,977

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