

2012 North Dakota State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Agriculture continues to be the dominant force in North Dakota's economy even though North Dakota has become the second largest oil producing state in the nation. The North Dakota Agricultural Experiment Station (ND AES) and NDSU Extension Service (NDSU ES) serve as major sources of innovation, new tools and knowledge, and educational support to agriculture's continued success. The following examples illustrate recent contributions in the areas of global food security, climate change, sustainable energy, food safety, childhood obesity, and citizen and leadership development.

Global Food Security

Good soil health is necessary to maintain or improve North Dakota's economic prosperity and minimize environmental impacts caused by land management practices, according to a soil health advisory group formed by NDSU. The soil health initiative is being spearheaded by the ND AES and NDSU ES. In 2012, three faculty and three scientists/ specialists have been added to the NDSU School of Natural Resource Sciences and Research Extension Centers at Langdon, Carrington, Minot and Hettinger to address issues related to soil health and land management. Saline and sodic (accumulated sodium) soils affect about 12.6 million acres of agricultural land in North Dakota. The soil health initiative team is collaborating and working on projects across the state. Projects include: tile drainage and sub-irrigation, soil salinity and sodicity research and Extension efforts in eastern North Dakota, impact of increased dust and road use on wetlands due to energy development in western North Dakota, impacts of climate and erosion on soil change and implications for North Dakota soil quality, and multiple land use issues concerning beef production and wildlife habitat.

The state of North Dakota and NDSU, through the Foundation Seedstocks Program (FSP) and North Dakota State Seed Department (NDSSD), release more certified seed than any other state. "Of course, one of the reasons is the great varieties that are released through NDSU," says Ken Bertsch, NDSSD commissioner. "The goal of both agencies is to provide genetically pure seed to the agriculture industry. We should not undervalue using high-quality seed when planting the high-revenue crops of today's market." NDSSD provides testing, inspections and regulatory services for all crops. FSP aims to increase, maintain and distribute genetically pure foundation class seed, coordinate with other agencies locally and globally, and implement improved systems for foundation seed increases and distribution. Production, conditioning and seed distribution locations are the Agronomy Seed Farm at Casselton and Research Extension Centers at Carrington, Langdon, Minot and Williston. "As an example of our work, 74 percent of the North Dakota wheat crop planted during the year has a seed history traceable back to FSP, which has a value of approximately \$2 billion and an overall economic impact of approximately \$6 billion," says Dale Williams, FSP director.

To further help North Dakota producers enhance their livestock care and husbandry at a time when they face an increasing demand for accountability in animal welfare issues, NDSU ES hired Gerald Stokka as NDSU's first livestock stewardship specialist. He is a former Pfizer Animal Health veterinary operations team member and is an internationally recognized expert in the care of beef cattle. "The term 'stewardship' means the careful and responsible use of something entrusted to one's care," Stokka says. "We have extended that definition to include 'and leaving behind a better place for the next generation.' We intend to bring an understanding to what is entrusted to us. It is not just the livestock, but the land and environment they are in, the air they breathe and how we - people and livestock - fit in the food production industry and global food security."

Climate Change

The 2012 growing season was one that really surprised most people: Warm, dry weather occurred throughout much of the state, yet crop yields exceeded the expectations of many. Also, although the moderate winter and spring resulted in a great calving season, the summer drought, hay and water shortages, and falling prices created challenges for many ranchers. In a similar light, many of our research and Extension activities also exceeded our expectations, and we continue to address current challenges faced by North Dakotans.

In 2001, the North Dakota Agricultural Weather Network (NDAWN) set a goal of having voice modems provide near real-time data with a simple phone call at all of the system's stations. By 2003, NDAWN had accomplished that goal, and growers quickly learned the value of that service. Today, NDAWN is utilizing the latest technology to provide the best service for the ever-growing NDAWN user base. NDAWN has started a transition with 12 stations (Edgeley, Ekre, Forest River, Inkster, Jamestown, Lisbon, Marion, Michigan, Oakes, Watford City, Plaza and Ross) now offering near real-time data on the NDAWN website. The information is easily viewed from any Web-browsing device and is especially designed for small screens such as smartphones. Providing updated data on the Web every 10 minutes is possible at these 12 stations because they have an IP (Internet Protocol) address through a wireless modem. The network provides weather data, which is instrumental in developing various agricultural models such as late blight, degree-day and growth stage for barley, corn, canola, potatoes, sugar beets, sunflowers, wheat and other small grains. NDAWN users also can monitor irrigation scheduling, crop water use, and the conditions for sugar beet root maggot and other insect development.

For various reasons including climate change, cropping patterns have changed during the past few decades. "New cropping technology and genetically modified seeds have escalated alternatives for growers," says William Wilson, distinguished professor in the Agribusiness and Applied Economics Department. "The changes have been dramatic in North Dakota and much of the country, especially in corn, soybeans and canola." The competing pressure on traditional crops is on for the "battle of the acres." Acres planted to traditional crops, such as hard red spring wheat and durum, have been declining. Wilson is optimistic that grain prices will remain high because of a worldwide increase in consumption, a decline in planted acres because of population expansion and a yield rate that is insufficient to meet demands, especially in China, Brazil and the former Soviet Union. "The U.S. will evolve to become a more dominant supplier, which will be driven, in part, by logistics, growth in supply and the advantages of genetically modified crops," Wilson says. In the future, Wilson says, producers will become much more intensive in the use of technology, diversification of crops and risk management. He sees more professionally managed operations and producers becoming more sophisticated to exploit demand changes to compete against emerging competitors.

In North Dakota, wheat still is the No. 1 crop. However, germplasm research is ongoing to develop improved wheat cultivars that perform better under changing environmental conditions. The Wheat Germplasm Enhancement (WGE) project at NDSU is directed toward identifying and transferring genes that improve disease resistance, grain quality and overall productivity. The team uses some of wheat's wild relatives, as well as elite cultivars, to incorporate new traits and improve existing traits in the germplasm. The team also uses radiation-induced breaks in chromosomes to map and clone genes. Research also includes the analysis of wheat alloplasmic lines (that carry cytoplasm from wheat relatives). Cytoplasmic components such as mitochondria help almost all living organisms grow. For example, mitochondrial dysfunction in humans leads to debilitating diseases such as infertility, Parkinson's, Alzheimer's and neuropathies. The NDSU WGE project is one of the very few groups in the world who have a large collection of wheat alloplasmic lines because of the pioneering work of NDSU geneticist S.S. Mann. These researchers look at alien cytoplasm for plant sterility, disease resistance, plant vigor and development, plus several other traits, all at the genomic and proteomic (entire set of proteins expressed by a plant) level.

Sustainable Energy

After six years of study, NDSU researchers have a better idea of whether growing perennial grasses for biofuel production is feasible. Researchers also are answering questions about biomass quality and processing. "Establishment of perennial grasses is time-consuming," says Guojie Wang, forage agronomist at the Central Grasslands Research Extension Center near Streeter. "However, whenever they

are established, they have the ability to produce steadily and have resilience to environmental variables such as drought." NDSU's Central Grasslands, Carrington, North Central and Williston Research Extension Centers are collaborating with Ducks Unlimited and the U.S. Department of Agriculture's Agricultural Research Service facility in Mandan on the perennial grasses research. Production in test plots of warm-season grasses, including switchgrass and big bluestem, was markedly higher in 2012 than in 2011, despite significant drought, Wang says. Researchers also found that weed control is essential for good stands of warm-season grasses. On the processing side, NDSU established the Biomass Testing Laboratory (BTL) at the USDA-ARS lab facility in Mandan. The BTL became fully operational in June 2012. Researchers also have evaluated in-field biomass bale collection and transportation strategies, and developed a pneumatic biomass stem-leaf separator that divides chopped switchgrass into streams of stems, which are a good biofuel feedstock, and leaves, which are good livestock fodder. Stems and leaves have more value separately than they do combined. The in-field evaluation found that using a self-loading bale picker to collect the nearest bales in sequence and the combination of a loader and a following truck were the best collection strategies.

NDSU is studying the feasibility of using new sugar beet varieties, known as energy beets, for ethanol production. Sugar beets for table sugar production are stored conventionally in open piles for up to six months under extremely low temperatures. However, storing sugar beets in open piles increases the risk of hot spots forming, which could lead to microbial degradation of sugars. Freezing also leads to the rupture of beet cell walls, making cell contents, including sugars, susceptible to leaching during thawing and washing. The thawing of sugar beets before processing requires large quantities of energy, which contributes to a less favorable greenhouse gas life cycle assessment. Because of these storage problems, new long-term storage techniques are needed to preserve fermentable sugars from energy beets to allow for ethanol production throughout the year. Results indicate that concentrating beet juice through evaporation to produce a raw, thick beet juice and subsequently adjusting the pH of the juice are effective. The technique helped retain more than 99 percent of the fermentable sugars in the juice stored for at least six months at 23 degrees Celsius (approximately 73 degrees Fahrenheit). During the study, the pH of the raw, thick juice was adjusted and controlled at alkaline and acidic levels to find the most effective ranges for sugar preservation. Although the juice was stored successfully, future research will be directed toward determining conditions for high-efficiency fermentation of the juice with the highest sugar retention during storage.

Food Safety

"Teens Serving Food Safely" is a statewide NDSU Extension Service food safety education effort designed to improve young food handlers' food safety knowledge and skills and decrease the risk of foodborne illness outbreaks associated with food service establishments. The "Teens" curriculum consists of five lessons based on the Fight BAC™ and Thermy™ national food safety campaign concepts, with pre/post and follow-up evaluation procedures. Youth benefit from the curriculum's experiential learning model, obtaining information and tools to share with their families. According to 2012 results, on average, knowledge scores increased from 54% on the pre-test to 86% on the post-test. About 58% of participants had been involved in the preparation of food for the public, and 91% prepare food for themselves or others every week. On the one-month follow up survey, 64% were more careful about cleaning and sanitizing, 44% had shared their knowledge about food safety with others, 72% reported washing their hands more often when preparing food and 37% have applied their knowledge when serving food for the public.

What your mother ate while pregnant could have an impact on your health. Chung Park, a professor and researcher in NDSU's Animal Sciences Department, and his research team have found a possible link between a pregnant woman's diet and her daughters' risk of developing breast cancer. High doses of lipotropes during pregnancy may decrease the daughters' chances of getting breast cancer. Lipotropes are essential nutrients that play key roles in modifying metabolic and genetic pathways. They are found in a variety of foods, including eggs, meat, fish, beans, milk and leafy vegetables. They're also available as dietary supplements. The team found that tumor development was delayed in the offspring from rats on the high-dose lipotrope diet. Those offspring also showed a significant decrease in the incidence of tumors, and tumor numbers and size, and the high-dose lipotropes did not affect mammary development. This study demonstrated for the first time that maternal high-dose lipotropes are associated with reduced

mammary tumor risk in the offspring. The team received grants from the National Institutes of Health and the Northern Canola Growers Association.

Child Obesity

According to the 2011 Youth Risk Behavior Survey, 11% of North Dakota's high school students were obese. Fruits and vegetables (FV), as part of a healthy diet, are important for optimal child growth, weight management, and chronic disease prevention. Less than 20% of North Dakota's children (especially low-income children) eat the recommended levels of fruits and vegetables. Motivating children to try FV and then regularly eat FV is a challenge. Research indicates that modeling by cartoon characters can increase FV intake among 5- to 11-year-olds. Behavior change is more likely to occur if children are engaged in experience-based, realistic activities. NDSU ES has adopted the University of Minnesota Extension's Go Wild With Fruits & Veggies (GWWFV) curriculum for third graders who participate in the Family Nutrition Program and other school-based educational programming. The GWWFV curriculum was created for grades three to five to motivate children to consume FV by integrating a different wild animal character into seven interactive lessons. A pilot test was conducted to determine the effectiveness of the program to increase fruit and vegetable intake among third grade participants. Results from the Go Wild intervention of 330 third graders reporting on the last lesson of the curriculum reveal their self-reported intake of fruits and vegetables significantly increased. Third graders reported consuming on average 0.98 cups of fruit before and 1.26 cups after the intervention. For vegetables, they report consuming an average of 0.88 cups before and 1.18 cups after the intervention. For fruits, 67% report they ate more fruit now than before the class, and 59% report consuming more vegetables now than before the class. Children are also communicating what they learn at home. Approximately 64% talked with their families about what they learned from GWWFV.

Citizen and Leadership Development

The rapidly growing oil and gas industry in western North Dakota is having significant impacts on people and communities. To meet the challenges, the NDSU ES Center for Community Vitality has conducted several "Taking Charge of Your Community's Future" forums. The forums assisted individuals and community leaders in the fringe communities to plan for the dynamic change, take advantage of the opportunities and help mitigate problems such as rapid growth and deal with issues such as mineral rights. Participants were asked to list actions they will take. The results included: study and develop planning and zoning ordinances, research and learn more about the mineral rights on owned property, prepare their communities in advance of oil industry impacts and become informed of mineral and surface rights and leasing, and be involved in preparing local governments for change. The sessions were held in Hettinger, Lansford, Glen Ullin and Underwood. The center has set up a website at www.ag.ndsu.edu/ccv/oil-and-gas-resources to provide resources to answer energy-related questions about mineral leasing and oil production.

NDSU is spearheading a multiyear project to improve the land and lives of people on the Standing Rock Sioux Reservation. The 2.2 million acre reservation straddles the North Dakota-South Dakota border and is home to about 9,000 people. Inadequate land management led to degraded rangeland conditions, including poor forage production, large prairie dog towns and considerable erosion potential. NDSU is partnering with South Dakota State University, the U.S. Department of Agriculture and Sitting Bull College (1994 Land grant) in an effort to renew the land and increase beef production on the reservation. "One of the main goals of this project is to develop a natural beef production system," says Gary Halvorson, Sitting Bull College Agribusiness Division chair and a project co-director. "This will provide a source of meat that is healthy and nutritious for the Standing Rock people." He hopes the project also adds ranching, beef processing and marketing jobs; exposes students to a high-quality research program and some of the best researchers in the world; and gives students opportunities to work on the research and conduct their own research. Project accomplishments include: evaluating the interaction of the Sioux people's cultural traditions and this project, completing initial evaluations of forage, soils and wildlife surveys, and initiating opportunities for students and Native American ranchers to learn modern and sustainable beef production strategies.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	55.0	0.0	51.0	0.0
Actual	55.0	0.0	51.0	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- External University Panel
- Combined External and Internal University Panel
- Expert Peer Review

2. Brief Explanation

Research programs were subjected to four different types of scientific peer review. These reviews occur prior to, during and at the conclusion of each research project. First, research faculty who participate in multistate research projects receive a critical review of their contributing project from fellow committee members, the administrative adviser and the North Central Multi-State Research Committee. Second, most faculty augment their multistate research funding with competitive grants. These grants are awarded on the basis of scientific merit and afford an opportunity for external peer review. Third, each research faculty member with the ND AES is required to have a station project that is reviewed for scientific merit by a Project Review Committee that is comprised of one faculty member from each discipline. Finally, all research is peer reviewed, either internally or externally, prior to publication.

Extension program leaders in agriculture and natural resources, family and consumer science, 4-H and youth development, and community resource development from the North Central Region meet twice a year to evaluate program needs and develop plans of work for the whole region. Ongoing efforts are made to update North Central regional logic models and develop and collect multistate impact indicators. Extension program leaders from North Dakota, South Dakota, Nebraska and Kansas typically meet annually to develop joint program opportunities for these four states. They exchange ideas on plans of work in an effort to increase the effectiveness of programs in their states; and programs impacting all four states have been developed as a result of these regular planning meetings. State Extension specialists frequently submit grant proposals to regional and federal agencies and commodity groups to fund applied-research and Extension program activities. These proposals are externally reviewed prior to selection for funding. Extension bulletins are internally peer reviewed prior to publication.

III. Stakeholder Input

1. Actions taken to seek stakeholder input that encouraged their participation

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Other (Input from State Board of Agricultural Research and Education)

Brief explanation.

Building linkages with the public enables us to discover information about community/county/district/state assets and needs. Various methods for stakeholder input are utilized on an on-going basis. Advisory and commodity boards are used annually to identify issues and refine research and Extension programs. Examples include county extension advisory boards, Sustainable Agriculture Research and Education (SARE) advisory board, nutrient management advisory board, sugar beet research and Extension board, research extension center (REC) advisory boards, and the State Board of Agricultural Research and Education (SBARE). Input from stakeholders, the general public and from targeted audiences is used to develop our five-year plan of work and to make adjustments to the plan based on crisis situations that may develop in the state, e.g. drought, flood, insect infestations, plant diseases, high-risk issues of youth, bioenergy economics, animal welfare issues. Using several methods and several venues to collect data ensure that high priority issues are identified, people that have self-interest in the issue are brought to the planning meetings, and the appropriate research project or educational program and design is developed to address the issue using a variety of delivery methods.

2(A). A brief statement of the process that was used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief explanation.

The State Board of Agricultural Research and Education (SBARE) is charged by the state legislature with determining the causes of any adverse economic impacts on crops and livestock produced in this state; developing ongoing strategies for the provision of research solutions to negate adverse economic impacts on crops and livestock produced in this state; developing ongoing strategies for the dissemination of research information through the NDSU ES; annually evaluating

the results of research and extension activities and expenditures; and reporting the findings to the North Dakota Legislative Council and the State Board of Higher Education. SBARE actively solicits input from all sectors of agricultural interests (i.e. different commodity and livestock groups) and meets throughout the state to gather input.

County commissioners actively participate in county extension program reviews with extension district directors. The county extension budgeting process also results in strong engagement from county government. Local needs are also identified through input from crop and livestock improvement boards, soil conservation districts, 4-H councils, and area focus groups. End of program surveys are used at most county and state extension programs to identify emerging clientele needs.

In 1992, the North Dakota Department of Human Services and NDSU ES were legislated by the North Dakota state legislature to form a statewide Family Life Education Committee. The committee is composed of state legislators, an Extension specialist, an Extension Human Development Agent, citizens with a parenting self-interest, two administrators from the Child Division of the State Department of Human Services and the Extension Assistant Director, Nutrition, Youth and Family Science. As a result of this partnership, the state Department of Human Services provides funding opportunities to six state family life education centers through a request for proposal process. The availability of designated funds also directs the focus of the parenting education programs provided through the six family life education center coordinators. The six family life education coordinators provide evaluation feedback to the Family Life Education Committee of the state Department of Human Services on program impacts. These impacts are then shared with state legislators.

The ND Department of Health, under the direction of the Governor of North Dakota, formed an alliance of organizations in ND that provide significant support and leadership for health-related initiatives. NDSU Extension is represented on this coalition. Networking among these professionals is invaluable, in addition to the legislative work.

2(B). A brief statement of the process that was used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals

Brief explanation.

- Meeting with traditional Stakeholder groups
- Survey of Traditional Stakeholder groups
- Meeting with Traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals

The process of collecting stakeholder input was described above along with the process in identifying stakeholder groups and individuals.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs

- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities

Brief explanation.

The State Board for Agricultural Research and Education (SBARE) is charged with developing ongoing strategies for the dissemination of research information through the ES; annually evaluating the results of research and Extension activities, recommending faculty and support positions and areas for program expenditures; and reporting the findings to the North Dakota Legislative Council and the State Board of Higher Education. Their findings directly affect the research and Extension budgeting process.

Commodity councils and research-education boards guide research and Extension program priorities and activities through their call for proposals, proposal review sessions, and grant funding.

The staff from the seven Research Extension Centers (RECs) uses the input from winter meetings with their advisory boards to set program direction for research projects and Extension programs at their centers.

During county staff evaluations each year, program input is gathered from commissioners who take part in the staff evaluations. This arrangement helps assure that extension programs are grass roots driven and are focused on local issues and needs. County commissioner input is also critical in determining the staffing level and emphasis within county Extension offices as 50 percent of the Extension agent's salary is paid by the county.

The statewide Family Life Education Committee, composed of state legislators, an Extension specialist, an Extension Human Development Agent, citizens with a parenting self-interest, two administrators from the Child Division of the State Department of Human Services and the Extension Assistant Director, Nutrition, Youth and Family Science determine the availability of designated funds which direct the focus of the parenting education programs provided through the six family life education center coordinators. The six family life education coordinators provide evaluation feedback to the Family Life Education Committee of the state Department of Human Services on program impacts. These impacts are then shared with state legislators which in turn affect budgeting.

Stakeholders are frequently important contributors on the search committees of Extension state specialists and county commissioners are partners in the search committees and interview process of county staff. A SBARE member or another stakeholder is often a representative on faculty position searches.

Brief Explanation of what you learned from your Stakeholders

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
3334530	0	2942418	0

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	1974400	0	2786700	0
Actual Matching	2962000	0	4189800	0
Actual All Other	0	0	0	0
Total Actual Expended	4936400	0	6976500	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security and Hunger
2	Climate Change
3	Sustainable Energy
4	Food Safety
5	Childhood Obesity
6	Citizenship and Leadership Development

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
121	Management of Range Resources	25%		0%	
202	Plant Genetic Resources	0%		15%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		15%	
204	Plant Product Quality and Utility (Preharvest)	0%		5%	
205	Plant Management Systems	50%		0%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		5%	
212	Pathogens and Nematodes Affecting Plants	0%		30%	
301	Reproductive Performance of Animals	5%		10%	
302	Nutrient Utilization in Animals	20%		10%	
305	Animal Physiological Processes	0%		5%	
702	Requirements and Function of Nutrients and Other Food Components	0%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	21.0	0.0	25.0	0.0
Actual Paid Professional	12.0	0.0	37.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
450000	0	1450000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
674000	0	2180000	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Meet with stakeholder groups to gather input and refine program directions.
 Develop improved crop cultivars acceptable to growers and those who use and process the grain.
 Conduct research on alternative grazing and feeding systems.
 Conduct research on the effect of maternal treatments on the productivity of offspring.
 Present crop and livestock research results at field days and grower meetings, popular press, radio and TV spots, web sites, and educational classes and workshops to foster producer adoption.
 Evaluate the effectiveness and impact of the extension programming.

2. Brief description of the target audience

Grain and livestock producers, crop consultants, nutritionists and feed personnel, veterinarians, Extension personnel, commodity groups, crop improvement associations, and grain processors.

3. How was eXtension used?

The 'Ask An Expert' widget/feature in eXtension was used in this program.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1169	45500	207	905

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	1	32	33

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of additional acres grown with new NDSU developed crop varieties with improved disease resistance and the ability to produce a high quality crop under both favorable and marginal growing conditions.
2	Number of North Dakota livestock producers with increased knowledge of practices to improve the efficiency of livestock production systems, including use of improved livestock genetics, use of practices to improve reproductive efficiency, and use of improved nutrition.
3	Increased percentage of livestock producers that utilized NDSU developed cover crop mixtures as forage to improve livestock production per land area, reduce costs to feed an animal, and ability to produce a high quality forage crop for livestock grazing under both favorable and marginal growing conditions.
4	Percentage of seeded acres in ND that are grown with new NDSU developed crop varieties with improved disease resistance and the ability to produce a high quality crop under both favorable and marginal growing conditions.

Outcome #1

1. Outcome Measures

Number of additional acres grown with new NDSU developed crop varieties with improved disease resistance and the ability to produce a high quality crop under both favorable and marginal growing conditions.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of North Dakota livestock producers with increased knowledge of practices to improve the efficiency of livestock production systems, including use of improved livestock genetics, use of practices to improve reproductive efficiency, and use of improved nutrition.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	50

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Feed costs are a major component of overall production costs in cow/calf, growing, and finishing cattle systems. Improving the efficiency of feed utilization or using lower cost feeds, therefore, can have dramatic effects on profitability and sustainability of the beef industry.

This research is aimed to improve the profitability of beef cattle production through improving efficiency of production and/or reducing input costs. Improving efficiency also has the potential to reduce the environmental impact of beef production systems. This research aims to improve efficiency of production through integrative research on nutrition, genetics, and reproduction of ruminants. These research objectives include both basic research to better understand physiological systems important in regulating feed efficiency as well as studies to examine the effects of different nutritional or management programs on performance in ruminants.

What has been done

Research projects were conducted on: 1) the effects of corn dried distillers grains plus solubles supplementation on backgrounding calf performance, 2) the effects of increasing corn distillers

grains plus solubles and degree of dry-rolled processing on finishing cattle performance, the effects of maternal nutrition on 3a) maternal pancreatic function and fetal pancreatic development, 3b) maternal and fetal hepatic and intestinal energy utilization, and 3c) maternal endocrine function as related to feed intake and energy balance.

Results

The summarized research results are: 1) supplementation with corn dried distillers grains plus solubles to growing cattle fed medium quality hay increased ADG, improved feed efficiency and decreased hay meal size and intake, 2) feeding 40% vs 20% corn dried distillers grains plus solubles improved feed efficiency, increased number of meals per day, and decreased meal size, and feeding fine-rolled vs. coarse-rolled corn influenced feeding behavior but did not influence growth performance in finishing cattle, 3a) nutrient restriction of ewes during early to mid-gestation decreases beta cell size in fetal pancreas in late gestation (samples from cow experiment currently being analyzed), 3b) nutrient restriction and realimentation during early and midgestation alters maternal and fetal liver and small intestinal mass and in vitro oxygen consumption in cows, and 3c) sample analysis is underway to determine effect of nutrient restriction on leptin and neuropeptide Y concentrations in plasma. These results have increased our knowledge on the effects of feeding corn dried distillers grains plus solubles and on corn processing on feeding behavior and growth performance in growing and finishing cattle. These results also have increased our knowledge on how maternal nutrition influences fetal development of pancreatic function and of energy metabolism in liver and intestine of pregnant ruminants, which could have long-term implications on post-natal performance, health, and longevity. Results have been presented at Extension and scientific meetings in ND and elsewhere.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
702	Requirements and Function of Nutrients and Other Food Components

Outcome #3

1. Outcome Measures

Increased percentage of livestock producers that utilized NDSU developed cover crop mixtures as forage to improve livestock production per land area, reduce costs to feed an animal, and ability to produce a high quality forage crop for livestock grazing under both favorable and marginal growing conditions.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Increasing the economic return and efficiency of harvesting forage and grain (and subsequent food) from the same land base is an innovative approach to increasing our food supply without adding land. A state-wide (North Dakota) livestock producer survey conducted by the North Dakota State University Animal Sciences Department showed almost 20% of our ranchers were interested in using cover crops (dual cropping) as a forage base in the future. Testing the economic efficiency of dual cropping the same land base versus a single cropping system and comparing to a traditional dry lot feeding system is important livestock growers and farmers to determine the success and failure in the Northern Plains. This practice also can create healthier soils and reduce input costs, thus creating a more sustainable ranching and farming operation that is cost effective and environmental safer. These environmental improvements can create cleaner drinking water, reduce erosion, and reduce carbon in the atmosphere.

What has been done

A five-year research/demonstration trial was developed study economic efficiency, livestock production, and grain/forage production on marginal cropland in south central North Dakota. The project was designed to compare no grazing, 50% grazing use, and full-grazing use on single and dual cropping systems and compare to dry lot. Parameters collected were to address if we can achieve more food production using NDSU cocktail mixtures from the same land area cheaper than a single crop system or dry lot. We also conducted a 1-day cover crop forum to train service provider professionals on using crop crops for soil health and livestock grazing. A post survey was conducted after the forum to provide guidance on future educational activities and material to develop.

Results

Full-use grazing a cover crop cocktail mixture following a barley crop for grain reduced the daily feed costs to the livestock producer by 239 % (\$0.89/day versus \$2.13/day) compared to dry lot feeding. Full-use grazing a cover crop cocktail mixture following a barley crop for grain increased per head return by 5% to the rancher compared to dry lot feeding. Early results indicate that livestock producers can dual harvest marginal cropland in south central North Dakota, while creating a harvestable grain crop that provided an economic return from the land. The second crop which was an NDSU designed cocktail mixture also provided an economic return when grazing at full-use. Heifers gained weight during the grazing period, creating an increased beef product from the same land that produced a grain crop. Outcomes from the cover crop forum survey indicated professional technical service providers desired more educational programs and materials. These programs should addressed recommended cover crop species for improving soil health and creating optimum grazing forage for livestock.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
302	Nutrient Utilization in Animals

Outcome #4

1. Outcome Measures

Percentage of seeded acres in ND that are grown with new NDSU developed crop varieties with improved disease resistance and the ability to produce a high quality crop under both favorable and marginal growing conditions.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	48

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Growers, crop consultants, end users, grain marketers seek wheat varieties with increased yield with maintained or improved quality profiles. All of these individuals rely on sale of grain to maintain the profitability and sustainability of their farms or their businesses. End use quality of new varieties is needed to maintain the milling and baking quality desired by processors and the consumer. Ultimately, wheat production needs to be increased to supply an increasing global demand for product.

What has been done

The durum wheat breeding/genetics program is developing improved varieties acceptable to growers in North Dakota and those who use and process the grain. Extension specialists shared this performance information with growers within North Dakota, and among peers in adjoining states.

Results

The state of North Dakota and NDSU, through the Foundation Seedstocks Program (FSP) and North Dakota State Seed Department (NDSSD), release more certified seed than any other state. NDSSD provides testing, inspections and regulatory services for all crops. FSP aims to increase, maintain and distribute genetically pure foundation class seed, coordinate with other agencies locally and globally, and implement improved systems for foundation seed increases and distribution. Production, conditioning and seed distribution locations are the Agronomy Seed Farm

at Casselton and Research Extension Centers at Carrington, Langdon, Minot and Williston. In 2012, 74 percent of the North Dakota wheat crop planted has a seed history traceable back to FSP, which has a value of approximately \$2 billion and an overall economic impact of approximately \$6 billion. Of all seeded acres in ND, 48 percent were grown with new NDSU developed crop varieties with improved disease resistance and the ability to produce a high quality crop under both favorable and marginal growing conditions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy

Brief Explanation

Even though North Dakota suffered drought in 2012, Global Food Security and Hunger goals for 2012 were met.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

See previous section.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	10%		10%	
103	Management of Saline and Sodic Soils and Salinity	15%		15%	
205	Plant Management Systems	7%		7%	
211	Insects, Mites, and Other Arthropods Affecting Plants	8%		8%	
212	Pathogens and Nematodes Affecting Plants	15%		15%	
213	Weeds Affecting Plants	15%		15%	
216	Integrated Pest Management Systems	10%		10%	
405	Drainage and Irrigation Systems and Facilities	20%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	17.2	0.0	15.2	0.0
Actual Paid Professional	22.0	0.0	24.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
823000	0	940000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1235000	0	1415000	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- 1) Establish best water management practices for North Dakota
- 2) Create systems to reclaim saline and sodic areas within farm fields
- 3) Calibrate fertilizer application under higher moisture environments
- 4) Adjust disease management for all the major crops due to increased rainfall and higher humidity
- 5) Survey and improve management recommendations for insect pests on the major crops
- 6) Adapt weed management strategies to changing cropping systems, including resistance management
- 7) Investigate agronomic systems that are adapted to the change in rainfall and longer growing season
- 8) Translate scientific findings into practical producer applications and provide transformational education through workshops, field days and conferences, and resource materials

2. Brief description of the target audience

- 1) Crop producers in both North Dakota and adjacent states
- 2) Crop consultants and agricultural advisors
- 3) County Extension personnel
- 4) Agribusiness and agricultural finance personnel
- 5) Government agency staff

3. How was eXtension used?

The Ask an Expert feature of eXtension was used in this program.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	10937	139000	6560	50015

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	4	2	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of farmers adopting new practices to achieve highly productive crops in a changing environment.
2	Number of farmers adopting new practices to improve pest management in a changing environment.
3	Number of farmers adopting improved soil and water management practices in response to a changing environment.
4	Number of acres impacted by producers adopting new practices to improve pest management in a changing environment.

Outcome #1

1. Outcome Measures

Number of farmers adopting new practices to achieve highly productive crops in a changing environment.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	110

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Each year, insects and diseases attack North Dakota's crops, potentially causing large losses in yield and quality. Crop producers need up-to-date data on pest occurrence, distribution and severity, so that they can make informed and timely management decisions. Correct and timely management decisions can make the difference between profit and loss for a crop that year.

What has been done

NDSU trained field scouts help producers stay informed about pest problems by surveying fields of major crops for insect and disease occurrence and severity. The survey has been titled the Integrated Pest Management (IPM) Survey, with the intent that once pests are found, they may need to be managed using IPM strategies. Field scouts are trained each year in late May and are provided with scouting protocols and equipment for accurate field scouting. In 2012, five field scouts surveyed five major crops (wheat, barley, soybean, sunflower and dry bean) across the state.

Results

Short term impacts relate to immediate information about pest problems. For example, in 2012 producers learned that wheat stripe rust developed early and reports of its occurrence allowed producers to make timely fungicide use decisions, resulting in improved yield. Information delivery was timely, either immediate or on a weekly basis via: NDSU Extension Crop and Pest Report; County Ag Alerts & Ag News releases; AgDakota list serve; and IPM maps posted on IPM website www.ag.ndsu.nodak.edu/aginfo/ndipm/. Long-term benefits of the IPM Survey includes: insect and disease occurrence or absence helps validate pest forecasting models; supports export of agricultural commodities as free of regulatory pests; shifts in disease presence and severity may indicate a race change, necessitating new management strategies; detection of pest resistance to pesticides; educational and research program needs identified; and improved

economic profitability of farms and reduced environmental impacts from pesticides.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

Number of farmers adopting new practices to improve pest management in a changing environment.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	114

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Example 1:

Glyphosate-resistant weeds, such as waterhemp, common ragweed, horseweed (marestail) and kochia continue to increase in North Dakota, especially in the eastern half. Based upon current greenhouse testing 30% of 22 kochia samples from 2012 have been confirmed glyphosate-resistant and potentially 60% of the eastern half of North Dakota crop acreage may now have some frequency of glyphosate-resistant kochia.

Example 2:

In 2012 nearly 97% of sugarbeet grown in Minnesota and North Dakota were planted to Roundup Ready® sugarbeet. Since the introduction of Roundup Ready sugarbeet in 2008, glyphosate-resistant weeds have continued to increase in both states due to the near exclusive use of glyphosate and near exclusive planting of Roundup Ready corn and soybean. According to the 2012 (44th Annual) sugarbeet grower survey, 20% of survey respondents planting Roundup Ready sugarbeet reported suspecting the presence of glyphosate-resistant weeds in sugarbeet

encompassing 10% of the reported sugarbeet acreage reported by growers planting Roundup Ready sugarbeet. In 2008, only 7% of Roundup Ready sugarbeet growers responding to the survey suspected having glyphosate-resistant weeds.

What has been done

Example 1:

Research is being conducted at NDSU by several Extension and research personnel in Fargo and Research Extension Centers across the state to reduce glyphosate-resistant weeds in North Dakota cropping systems and maximize herbicide activity through the use of adjuvants. The adoption of preemergence herbicides in North Dakota has been slow. In 2009, preemergence herbicides were applied to only 4 percent of soybean acreage.

Example 2:

Sugarbeet grower winter seminars, workshops for sugarbeet cooperative agriculturalists, field days, and field and greenhouse research have been conducted to educate growers and the industry about the growth in glyphosate-resistant weeds and how to properly manage these weeds in sugarbeet and other crops in the rotation. In addition extension publications and a video entitled "Scouting for Glyphosate Resistance" have been developed over time and made available to growers and the sugarbeet industry. Recommendations to sugarbeet growers have been to apply glyphosate at maximum legal rates within each application to small annual weeds, include herbicides having alternative sites of action with glyphosate, hand-weed and row-cultivate fields and manage weeds properly in other crops within the rotation.

Results

Example 1:

A recent field trial showed the use of a preemergence herbicide followed by two glyphosate applications in Roundup Ready soybean improved glyphosate-resistant common ragweed control and soybean yield by 20 and 25%, respectively, however weed control was only 78%. This same trial showed the use of a preemergence herbicide followed by two Liberty applications improved weed control by 41% to 99% and LibertyLink soybean yield by 25%. This herbicide program in Roundup Ready soybean and LibertyLink soybean increased profits \$14.00/A and \$7.00/A, respectively. At 4.7 million acres of soybean in North Dakota and \$14.00/bu soybean, growers could potentially improve cash receipts for the state by \$32.9 million by planting LibertyLink soybean and maintain near 100% weed control.

Example 2:

To reduce the risk of developing herbicide resistance or manage resistance, more growers are using diverse weed management practices. Initially nearly 100% of sugarbeet growers only used glyphosate on glyphosate-tolerant sugarbeets. However, after training programs, growers used glyphosate tank mixtures on 24% of their acres in 2012 and soil residual herbicides on over 4% of the acres. Sugarbeet growers have even increased their use of hand weeding as an option. In 2012, 5% of glyphosate-tolerant sugarbeet acres were hand weeded. These improved practices will prevent future yield losses from herbicide resistant weeds.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
213	Weeds Affecting Plants

Outcome #3

1. Outcome Measures

Number of farmers adopting improved soil and water management practices in response to a changing environment.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	110

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Since 1993, above average annual precipitation has created excess water on the landscape and this has impacted crop production significantly in North Dakota.

What has been done

During 2012 presentations about tile drainage were given at 60 meetings throughout North Dakota and the Red River basin area of Minnesota. Eight different counties conducted tile drainage seminars. Training was provided for government agencies such as the Farm Service Agency, the Red River Basin Technical Scientific Advisory Council and the Fargo-Moorhead Diversion Ag Policy subcommittee. Seminars were given to several businesses and industries. Subsurface drainage educational presentations were given at state events such as crop advisor workshops, crop association and professional organization meetings. Also, NDSU ES cooperated with South Dakota State University ES and the University of Minnesota ES to organized five, 2-day tile drainage design workshops. Two were held in North Dakota, two in South Dakota and one in Minnesota.

Results

Tile drainage education was provided to over 3,000 educational seminar participants in 2012. Each of the five tile design workshops was evaluated with an 'end of the course' survey. One question asked was "If you were to place a dollar value on the information you received (when you apply the knowledge you learned in your business and not the price you paid today) what would it be?" Responding participants indicated the perceived value was well over 2 million dollars.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
405	Drainage and Irrigation Systems and Facilities

Outcome #4

1. Outcome Measures

Number of acres impacted by producers adopting new practices to improve pest management in a changing environment.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	151924

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

From 2000 through 2012, harvested soybean acreage in North Dakota increased from 1.8 to 4.7 million acres. Due to the increased interest in soybean production in North Dakota, there is a need to educate newer growers about all production aspects of growing soybean in the different regions of the state. The meetings educated soybean growers on variety selection, soybean diseases, intensive crop management, and the new pest in North Dakota, soybean cyst nematode.

What has been done

The NDSU ES state and area specialist with responsibility for soybean and county agents developed a training program called "Getting it Right in Soybean Production." Meetings were conducted in 2012. Many other local events including plot tours were conducted throughout the state.

Results

After attending the educational events, producers were asked the question: If you were to place a dollar value on the information you received (when you apply the knowledge you learned today in your business), what would it be per acre? The average of those who answered (26% of attendees) was \$9.53 per acre. The growers reported they, on average, managed 450, 1,070 and 1,338 soybean acres in Langdon, Oakes and Jamestown, respectively. The total perceived value

across the three locations for "Getting it Right" locations was in excess of 1.27 million dollars. This excludes impacts from the other educational events. Producers indicated that they had obtained useful information to make their farming operation more profitable.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations

Brief Explanation

Even though North Dakota suffered a drought in 2012, Climate Change goals for 2012 were met.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Evaluation results are explained in each Outcome Target Results section.

Key Items of Evaluation

Integrated Pest Management (IPM) is an integral part of North Dakota's agriculture. IPM is a program to manage pests that combines a number of strategies to reduce pest risks, while improving economic profitability of farms and reducing environmental impacts from pesticides. Benefits of IPM include: reduced crop loss and improved crop quality; judicious use of pesticides in combination with non-chemical strategies, which results in improved protection of environment and health; reduced pest resistance; increased partnerships among growers, commodity groups, universities, consultants, industry and agencies, to improve pest management; and implementation of improved strategies and products through research.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
205	Plant Management Systems	5%		5%	
402	Engineering Systems and Equipment	20%		20%	
404	Instrumentation and Control Systems	10%		10%	
511	New and Improved Non-Food Products and Processes	10%		10%	
512	Quality Maintenance in Storing and Marketing Non-Food Products	20%		20%	
601	Economics of Agricultural Production and Farm Management	15%		15%	
604	Marketing and Distribution Practices	20%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	2.6	0.0
Actual Paid Professional	3.0	0.0	2.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
112000	0	102000	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
168000	0	153000	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- 1) Conduct research on processing, densifying, storage, and transportation of biomass.
- 2) Conduct economic analyses of biomass sources for energy production.
- 3) Develop market quality and testing standards, including supporting infrastructure.
- 4) Assist growers in new producing regions with business organization, technology adoption, and market development, and formation of risk management strategies.
- 5) Provide educational materials and programming on production, economics, and policy analysis to decision makers, growers, and industry personnel.

2. Brief description of the target audience

- Farmers
- Policy makers

- Biomass processors
- Equipment manufacturers

3. How was eXtension used?

The Ask an Expert feature of eXtension was used in this program.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	500	1000	0	0

2. Number of Patent Applications Submitted (Standard Research Output)
Patent Applications Submitted

Year: 2012
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	2	4	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of growers and industry personnel who use research-based economic analyses when they assess biomass/energy beet contracts; rely on densification technologies to collect, store and transport biomass/energy beets; and employ risk management strategies when they develop their business organizations to supply biomass/energy beets.
2	Number of growers and industry personnel who are aware of the potential opportunities of growing and processing energy beets or cellulosic biomass for industrial sugars or other biofuel feedstock.

Outcome #1

1. Outcome Measures

Number of growers and industry personnel who use research-based economic analyses when they assess biomass/energy beet contracts; rely on densification technologies to collect, store and transport biomass/energy beets; and employ risk management strategies when they develop their business organizations to supply biomass/energy beets.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of growers and industry personnel who are aware of the potential opportunities of growing and processing energy beets or cellulosic biomass for industrial sugars or other biofuel feedstock.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Energy beets have a strong potential for filling the niche of "advanced biofuels" as defined in the renewable fuel standard of the 2007 Energy Independence and Security Act. Energy beets also are being considered as a source for industrial sugar for other bioproducts. North Dakota farmers have strong experience growing sugar beets and this experience and the cold climate may allow for more economical beet production and storage than is possible in other areas of the country. Preliminary economic analyses suggest that energy beets may be produced in new areas of the state with strong yields and return for growers and processors.

What has been done

Research and extension personnel have worked closely with a group of ND industrial leaders to explore the agronomic and economic potential of growing energy beets through ND. The team has met with growers in a number of areas to educate them about the opportunity and discuss any questions they have. Research work and associated discussions with the public have included agricultural production, processing options, economic potential, and regulatory issues.

Results

NDSU is studying the feasibility of using new sugar beet varieties, known as energy beets, for ethanol production. Sugar beets for table sugar production are stored conventionally in open piles for up to six months under extremely low temperatures. However, storing sugar beets in open piles increases the risk of hot spots forming, which could lead to microbial degradation of sugars. Freezing also leads to the rupture of beet cell walls, making cell contents, including sugars, susceptible to leaching during thawing and washing. The thawing of sugar beets before processing requires large quantities of energy, which contributes to a less favorable greenhouse gas life cycle assessment. Because of these storage problems, new long-term storage techniques are needed to preserve fermentable sugars from energy beets to allow for ethanol production throughout the year. Results indicate that concentrating beet juice through evaporation to produce a raw, thick beet juice and subsequently adjusting the pH of the juice are effective. The technique helped retain more than 99 percent of the fermentable sugars in the juice stored for at least six months at 23 degrees Celsius (approximately 73 degrees Fahrenheit). During the study, the pH of the raw, thick juice was adjusted and controlled at alkaline and acidic levels to find the most effective ranges for sugar preservation. Although the juice was stored successfully, future research will be directed toward determining conditions for high-efficiency fermentation of the juice with the highest sugar retention during storage.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes
512	Quality Maintenance in Storing and Marketing Non-Food Products
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Government Regulations

Brief Explanation

Although outcomes were strong, there is recognition that the local and national economic situations affect biofuels markets and the likelihood of growers adopting a new crop. Returns on agricultural land in ND are generally strong and the state is benefitting from the strong agricultural and energy industries. Enforcement of the mandated levels of advanced biofuel production is essential to the development of this opportunity in ND.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

No formal evaluations for of extension programming were completed this period as

the primary investigator was killed in a farming accident.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Food Safety

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
504	Home and Commercial Food Service	75%		25%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	25%		75%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	1.8	0.0	7.5	0.0
Actual Paid Professional	1.8	0.0	6.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
67400	0	235800	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
101000	0	353800	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Implement programs for children and adults based on Fight BAC, Thermy, Produce Safety and BAC Down campaigns; USDA food preservation rules; and implement food safety programs for foodservice and processors (ServSafe, TAPS, HACCP).

2. Brief description of the target audience

- Children in school and youth program settings
- Teen food handlers in high school and community
- Adults in home settings
- Volunteer food handlers in community settings
- Professionals in foodservice and food processing environments

3. How was eXtension used?

News releases were contributed to Families, Food and Fitness CoP. The Ask an Expert feature of eXtension was also used in this program.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1800	263000	2000	12000

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	2	1	3

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Based on post-surveys, 50 percent of teens will report changes in food handling practices to reduce risk of foodborne illness outbreaks
2	Seventy-five percent of foodservice and food industry participants in ServSafe, HACCP or other food sanitation courses will pass the examination and become certified.
3	Based on post-surveys, 50 percent of adult participants in consumer food safety classes will report intent to change one or more food handling behaviors.

Outcome #1

1. Outcome Measures

Based on post-surveys, 50 percent of teens will report changes in food handling practices to reduce risk of foodborne illness outbreaks

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	64

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

"Teens Serving Food Safely" is a statewide NDSU Extension Service food safety education effort designed to improve young food handlers' food safety knowledge and skills and decrease the risk of foodborne illness outbreaks associated with food service establishments. According to a 2002 U.S. Department of Labor report, 22% of employed 15- to 17-year olds work in eating and drinking establishments. According to the National Restaurant Association pocket fact book in 2004, one-third of all employed 15 to 17 year olds work in eating and drinking establishments.

What has been done

The "Teens" curriculum consists of five lessons based on the "Fight BAC!" and "Thermy" national food safety campaign concepts, with pre/post and follow-up evaluation procedures. Youth benefit from the curriculum's experiential learning model, obtaining information and tools to share with their families.

Results

Since 2003, 8,233 North Dakota teens have been trained and received completion certificates based on the "Teens Serving Food Safely" curriculum. According to the past year's results, on average, knowledge scores increased from 54% on the pre-test to 86% on the post-test. About 58% of participants had been involved in the preparation of food for the public, and 91% prepare food for themselves or others every week. On the one-month follow up survey, 64% were more careful about cleaning and sanitizing, 44% had shared their knowledge about food safety with others, 72% reported washing their hands more often when preparing food and 37% have applied their knowledge when serving food for the public.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Seventy-five percent of foodservice and food industry participants in ServSafe, HACCP or other food sanitation courses will pass the examination and become certified.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Based on post-surveys, 50 percent of adult participants in consumer food safety classes will report intent to change one or more food handling behaviors.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	58

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Consumer food handling remains an issue of concern, and evaluations focused on outdoor grilling, a popular cooking method, and food preservation. Grilling is one of the healthier methods of preparing food; however, food safety issues, including quality issues and lack of thermometer use, have been cited as issues. Interest in food preservation has increased with rising food prices and renewed interests in local foods and gardening. Many younger adults lack experience with food preservation techniques and are seeking training so they preserve foods safely.

What has been done

A Barbeque Boot Camp program was initiated that brought together Extension, meat science, and food safety specialists and faculty from the Department of Animal Science, along with Extension agriculture and family and consumer science agents from across North Dakota. The boot camps

were held in four locations in North Dakota.

Educational programs in grilling, food safety and food preservation took place in classroom-type settings. Participants received a food thermometer and educational materials to use at home. Food preservation classes were held in nine counties.

Results

The BBQ Boot Camp reached 734 participants and overall, about 4,000 people in the past four years. Post-test scores showed that participants significantly increased their knowledge and indicated they would change their behavior. According to a follow-up survey, 83% of participants reported that they use meat thermometers and 58% of participants said they had changed their meat purchasing decisions after attending the program.

Nearly 600 people attended food preservation classes, some in hands-on classes and some in lecture/discussion. According to evaluations, 97% of attendees reported learning something new and indicated plans to use the information. About 72% planned to make jams/jellies, 39% planned to can fruit, 59% planned to freeze vegetables and 59% planned to can salsa and pickles.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

Even though North Dakota suffered drought in 2012, Food Safety goals for 2012 were met.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This study analyzed student interest in food safety-related degrees and careers following exposure to marketing and educational interventions. Following expert review and approval by the university's Institutional Review Board, pre- and post-surveys were administered to high school students enrolled in food-related classes in seven high schools (n=138; 51% females). Participants were assigned to one of three treatment groups. Treatment interventions (video, brochure, hands-on game) were introduced to students immediately upon completion of the pre-survey. A follow-up survey was conducted three weeks later. Participants (18%) agreed with the statement "plan to enroll in a food safety

program" (up 2% from Survey One). However, 79% of the participants do not know whether or not the college they may attend offers a food safety program. The percentage of individuals who have decided on a major increased to 39%, following an intervention (up 7%). The number of undecided individuals was greatest at the freshman level (38%). The percentage of individuals who have decided on a major was greatest among those in the video group (52%), compared to those in the brochure (27%), or game (21%) groups. Participants (54%) ranked annual income as the most influential factor in selecting a major. More females (16%) than males (10%) currently are working in food-related jobs.

To address the U.S. national need for food-safety experts, a variety of educational interventions should be utilized to target high-school students as early as freshman year.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Childhood Obesity

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	45%		45%	
724	Healthy Lifestyle	35%		35%	
802	Human Development and Family Well-Being	10%		10%	
806	Youth Development	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	0.7	0.0
Actual Paid Professional	4.0	0.0	1.5	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
148000	0	58900	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
224000	0	88000	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

School-based curricula, including "On the Move to Better Health", "Banking on Strong Bones", and "Going Wild" will continue to be used with children. Community-based programs for adults and children, including "Walk North Dakota" and "Moving More, Eating Smarter," will continue.

2. Brief description of the target audience

Children and adults will be the target groups for the programming. They will be reached with both direct and indirect methods.

3. How was eXtension used?

The Ask an Expert feature of eXtension was used in this program.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5850	299000	11440	22000

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	4	2	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of children participating in the youth education curricula who will improve their diet quality and/or their physical activity level.
2	Number of adults participating in adult education curricula who will improve their knowledge of current nutrition and/or physical activity level.

Outcome #1

1. Outcome Measures

Number of children participating in the youth education curricula who will improve their diet quality and/or their physical activity level.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	2478

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Children in elementary classrooms and afterschool programs have been targeted with nutrition education programming. Multi-lesson curricula that integrate nutrition and fitness concepts for grades four to five have been used statewide.

What has been done

The overall goal of the "Eat Smart. Play Hard. Together." program is to increase knowledge and change behavior among children and their parents through the use of two curricula in elementary schools and a recognition program used in 4-H clubs. "Banking on Strong Bones" is a five-week, school-based educational intervention for fourth graders. The purpose is to increase knowledge and change behavior regarding calcium-rich foods and weight-bearing activities. "On the Move to Better Health" is a five-week school-based curriculum for fifth graders, which aims to increase fruits, vegetables and calcium-rich foods in the diets of children, as well as increase physical activity. 4-H clubs completed an evaluation process to determine if their club met the "healthy club" criteria.

Results

From 2005-10, the "Banking on Strong Bones" five-lesson program has reached more than 7,000 children and their families. Students improved their knowledge scores and reported positive attitude and behavior changes toward consumption of dairy products. About 1,000 fourth graders participated in the 2011-2012 school year. On the pre-survey, 36% reported drinking three or more glasses of milk the previous day, compared to 56% on the post-survey. On the pre-survey, 21% reported drinking soda pop every day, compared to 11% on the post-survey. About 90% reported planned to drink more milk. According to the post-surveys of 1,000 fifth graders in the five-week "On the Move to Better Health" program, about 63% reported increasing the amount of fruits and vegetables they consumed, 58% reported drinking more milk, 60% reported drinking

less soda pop, 62% drank more water, 62% chose healthier snacks, and 63% increased the amount of daily physical activity. In 4-H youth programming, 478 children from 27 4-H Clubs from 12 counties were recognized for completing the criteria required for recognition as "healthy clubs."

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
802	Human Development and Family Well-Being
806	Youth Development

Outcome #2

1. Outcome Measures

Number of adults participating in adult education curricula who will improve their knowledge of current nutrition and/or physical activity level.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	330

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the 2011 Youth Risk Behavior Survey, 11% of North Dakota's high school students were obese. Fruits and vegetables (FV), as part of a healthy diet, are important for optimal child growth, weight management, and chronic disease prevention. Less than 20% of North Dakota's children (especially low-income children) eat the recommended levels of fruits and vegetables. Motivating children to try FV and then regularly eat FV is a challenge. Research indicates that modeling by cartoon characters can increase FV intake among 5- to 11-year-olds. Behavior change is more likely to occur if children are engaged in experience-based, realistic activities.

What has been done

NDSU ES has adopted the University of Minnesota Extension's "Go Wild With Fruits & Veggies" (GWWFV) curriculum for third graders who participate in the Family Nutrition Program and other school-based educational programming. The GWWFV curriculum was created for grades three to five to motivate children to consume FV by integrating a different wild animal character into seven

interactive lessons. A pilot test was conducted to determine the effectiveness of the program to increase fruit and vegetable intake among third grade participants.

Results

Results from the "Go Wild" intervention of 330 third graders reporting on the last lesson of the curriculum reveal their self-reported intake of FV significantly increased. Third graders report consuming on most days an average of 0.98 cups of fruit before and 1.26 cups after the intervention. For vegetables on most days, they report consuming an average of 0.88 cups before and 1.18 cups after the intervention. For fruits, 67% report they ate more fruit now than before the class, and 59% report consuming more vegetables now than before the class. Children are also communicating what they learn at home. Approximately 64% talked with their families about what they learned from GWWFV.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Even though North Dakota suffered drought in 2012, Childhood Obesity goals for 2012 were met.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The purpose of the "Shape Up for Spring" study was to assess the influence of educational delivery modes (email, Facebook) on nutrition and physical activity knowledge and behavior compared with a control group. Participants (n=92, 87% female, 31% aged 55 or above) were randomly assigned to one of three groups (Facebook, email or control). Eighteen educational messages were delivered by email or Facebook during the six-week project. The Facebook group had the opportunity to interact within their group. All groups were eligible to receive weekly nutrition and fitness incentive prizes. Online pre- and post-surveys were used to assess knowledge gain and achievement of individual goals related to nutrition and fitness. Of the 92 participants who completed the pre-survey, 85 (92%) completed the post-survey. Data were analyzed using the SPSS computer program. Both the Facebook and email groups significantly increased their knowledge scores, but the control group showed a decrease in knowledge scores. About 79% of the email group read the majority of the messages, compared with 56% of the Facebook group. About 31% of control group participants continued involvement in other health programs during the study, higher than the email (20.7%) or Facebook (22.2%) groups. The Facebook and email participants assigned themselves significantly higher average ratings in goal achievement

than the control group ($p < .05$).

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Citizenship and Leadership Development

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
602	Business Management, Finance, and Taxation	20%		20%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	5%		5%	
806	Youth Development	75%		75%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	8.0	0.0	0.0	0.0
Actual Paid Professional	10.0	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
374000	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
560000	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

4-H and other youth centered programs were utilized to teach youth about the importance of nutrition, health, exercise, the importance of volunteering and leadership, and provide them with basic knowledge of agriculture and why agriculture is so important to their everyday lives.

The RLND Class V (2011-2013) was selected with orientation in fall 2011. The 18-month curriculum included 10 seminars including tours and expert presentations on issues. Participants were also responsible for developing a project or advancing an issue for their community or organization.

2. Brief description of the target audience

Surveys were conducted in select 4-H clubs and groups.

The RLND Class V consisted of approximately 20+ adults who have agricultural or rural community interests, and were targeted for citizenship events.

3. How was eXtension used?

The Ask an Expert feature of eXtension was used in this program.

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	20000	10000	23807	10000

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2012
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	4	1	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- {No Data Entered}

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Characterize the positive personality traits of 4-H youth compared to non 4-H youth.
2	Percentage of 4-H club members who show improved leadership skills.
3	Number of community projects initiated by participants enrolled in Rural Leadership North Dakota.
4	Percentage of youth who increase their knowledge of or confidence in their gardening skills.

Outcome #1

1. Outcome Measures

Characterize the positive personality traits of 4-H youth compared to non 4-H youth.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Percentage of 4-H club members who show improved leadership skills.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of community projects initiated by participants enrolled in Rural Leadership North Dakota.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	23

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Rural Leadership North Dakota (RLND) is an 18-month leadership development program for anyone who wants to learn how to help improve his or her organization, business, farm or ranch operation, or community. Participants have greater knowledge in regards to project assessment and management. They have learned how to build consensus and bring all parties to the table when making community decisions. Because of these skills, communities have benefitted from more effective decision making processes and knowledgeable leaders. Participants consider themselves leaders and are empowered to make a difference in their communities.

What has been done

RLND Class V participants self-selected a community or organization project when they started the program in December 2011. Participants have been working on completing the project over the past year. Participants selected a project that they were passionate about and that filled a need in their community or organization.

Results

One RLND participant purchased and opened a restaurant that had been closed for over a year. The participant and his family remodeled the interior of the restaurant and opened it the end of June 2012. The plan is to operate the restaurant on a seasonal basis from April to December of every year, employing 5-6 individuals from the community.

Another project was to raise funds to purchase a newer fire truck for the community. The RLND participant was successful in raising the funds needed to purchase the fire truck in the fall of 2012.

A third project involved developing a marketing plan for a community in western North Dakota. The RLND participant is partnering with a company to create a DVD about the community and the changes that have taken place over the past few years due to the discovery of oil in the Bakken formation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #4

1. Outcome Measures

Percentage of youth who increase their knowledge of or confidence in their gardening skills.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	24

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Food is getting very expensive. Many families have lost the skills or desire to grow their own

food. Many of them also do not know how to prepare and make use of fresh vegetable, and there is little awareness of how affordable home raised vegetables are and what can be done with the excess.

What has been done

The Junior Master Gardener program teaches youth to take an active role in serving others and making their schools and communities stronger, better places. Giving time and effort to others while learning a great deal in the process is the foundation of what being a Junior Master Gardener is all about. Youth were taught in container gardening, gardening in small places, soil analysis and testing, and where to get information.

Results

The Junior Master Gardener program provided training to an estimated 3,500 youth in 46 projects from 35 counties in North Dakota.

Post-training Survey Indicated:

- 25% increased their knowledge about fertilizer and how it works
- 28% increased their knowledge about how plants use slow release fertilizer
- 24% indicated that they have confidence in growing plants
- 81% had success in keeping their tomato alive
- 74% had plants that produced tomatoes
- 37% had problems that they went to someone for information

A sampling of the evaluations from JMG project coordinators indicated about 80 percent of the projects involving vegetable gardening included some donation of the produce to a food bank, shelter, school, or families in the community. Most felt the practice of participating in gardening will help the students in school, particularly in math and science.

The JMG programs provided some participants with their first experience with gardening in the program, hopefully leading to a sustainable interest which positively impacts them for a lifetime.

Qualitative comments included:

"Most of our produce over the summer has been donated to the Senior Citizen Center, where it is used in the noon menu and also distributed to the Senior Citizens. We also deliver to several senior citizens that do not go to the Center. We also donated to two families that are receiving special help through social services."

"I thought when you put out those small planters that they could never produce anything of significance - boy, was I wrong! We pick tomatoes every day."

4. Associated Knowledge Areas

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Despite a strong economy and low unemployment, the Junior Master Gardener program is valuable to low income familoies in North Dakota. Thr programs for youth also target Native Americans, New Americans, and minority youth.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

RLND participants attended five seminars over the past year. The evaluation showed a relative increase in learning on the 20 objectives (four objectives for every seminar) that ranged from 24% to 160%.

Key Items of Evaluation