PLAN OF WORK REPORT OF ACCOMPLISHMENT

University of Nebraska Agricultural Research Division
Institute of Agriculture and Natural Resources
University of Nebraska-Lincoln

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Federal Fiscal Years
2000 to 2005

2004 Annual Report
PLAN OF WORK
University of Nebraska Agricultural Research Division

INTRODUCTION

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Annual Report
University of Nebraska
Agricultural Research Division

I. INTRODUCTION:

The University of Nebraska Agricultural Research Division is a division of the University of Nebraska Institute of Agriculture and Natural Resources (IANR). Other divisions include the Cooperative Extension Division and the College of Agricultural Sciences and Natural Resources.

This annual report describes the Agricultural Research Division program impacts and accomplishments for fiscal year 2004 as required by the Agricultural Research, Extension, and Education Reform Act of 1998. It includes the elements identified in the USDA document, "Guidelines for Land Grant Institution - Annual Report." This federal annual report is based on the implementation of the current Strategic Plan of the Institute of Agriculture and Natural Resources and on emerging issues identified through stakeholder input in anticipation of beginning the next revision of the IANR Strategic Plan. This federal annual report is for the University of Nebraska Agricultural Research Division only, but was developed in conjunction with University of Nebraska Cooperative Extension Division's annual report.

In FY 2004, Agricultural Research Division expenditures in support of the programs described in this plan totaled $75,338,345. Of this amount, Federal Formula Funds provided $3,484,037 or 4.6% of the total funds expended.

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Darrell W. Nelson, Dean and Director
Agricultural Research Division

2004 Agricultural Research Division
Plan of Work
Annual Report

A. Planned Programs

Federal Goal I. To achieve an agricultural production system that is highly competitive in the global economy.

Overview - Research Results Related to Goal 1

Under this goal area, research programs relate to the production, marketing and processing of the major livestock species, traditional field crops, specialty crops such as dry edible beans and turf. The research also relates to new crops, increased instate production and processing and development of new products and services. There were a number of significant outputs from the research programs. Impact statements are enclosed at the end of this section providing more detail.

University of Nebraska agricultural scientists and Cooperative Extension staff have identified and are educating producers about promising alternative crops for the Nebraska Panhandle's arid high plains climate. New crops being grown in the Panhandle as a result of these efforts include: proso and foxtail millet and sunflowers for birdseed; chickpeas for human food; turf and forage grass seed, and chicory. Birdseed crops now grow on 250,000 Panhandle acres and birdseed production is a $20 million a year industry.

University of Nebraska biochemists discovered how to genetically modify broadleaf crops so they can tolerate dicamba spraying. The Institute of Agriculture and Natural Resources researchers identified a soil bacterium that easily breaks down dicamba and then isolated the gene responsible for dicamba inactivation. Dicamba-based herbicides are relatively inexpensive and easy on the environment because the chemical disappears quickly in plants and soil.

Ranchers typically equate lighter weight replacement heifers with poor pregnancy rates and calving difficulty. However, University of Nebraska animal scientists found no difference in reproductive performance between spring-born replacement heifers developed to traditional and lighter weights. Feeding heifers to 53 percent of mature weight costs $22 per head less during the development period than feeding to traditional replacement weights.

Examples of accomplishments are included in the attached impact statements. These offer evidence of the impact that the Agricultural Research Division outputs are making towards the specific Nebraska ARD goals under Federal Goal I. The Nebraska goals are:

1. Enhance plant and animal production systems to be more profitable and sustainable.
2. Support agribusiness and economic development, including marketing and value-added processing of agricultural commodities.
3. Increase public/consumer understanding of food systems.

Goal I Resources

Source of Funds	Federal*	State	All Other	Total
FY 2004 Expenditures ($ x 1,000)	$2,517	$21,350	$26,308	$50,175

Faculty SYs in FY 2004 - 90.4

* Includes Hatch, Multistate, McIntire-Stennis and Animal Health funds

Impact Statements Related to Federal Goal I – Identified by Key Themes

Category: Competitive Agricultural Systems in a Global Economy
Key Theme: Adding value to new and old agricultural products

Impact Statement: Higher-Value Alternative Crops for the Panhandle
(Relates to Nebraska Subgoal 1 & 2, Output Indicator 4, and Outcome Indicators 3 & 4)

Issue:

Alternative, higher-value crops can broaden crop options for farmers and bolster regional economies, but new crops also are risky.

What has been done?

University of Nebraska agricultural scientists and Cooperative Extension staff have identified and are educating producers about promising alternative crops for the Nebraska Panhandle's arid high plains climate. The effort focuses on alternatives with higher value potential for growers and the region's economy. Studies have revealed how best to plant, manage and harvest several new crops. Scientists identify existing varieties best suited to local growing conditions or breed new varieties for the region and explore a new crop's market potential. New crops being grown in the Panhandle as a result of these efforts include: proso and foxtail millet and sunflowers for birdseed; chickpeas for human food; turf and forage grass seed, and chicory. Brown mustard and canola for environmentally friendly bio-diesel production are among the latest crops being studied.

Impact:

New crops have expanded farmers' production options and added millions of dollars to the region's economy. Birdseed crops now grow on 250,000 Panhandle acres. Birdseed production is a $20 million a year industry, including several processing plants that extension staff helped attract to the region. Panhandle growers produce about 1,500 acres of grass seed valued at $1 million annually. The region's 900 acres of chicory, valued at $1 million annually, are processed at the nation's only chicory processing plant at Scottsbluff, which opened in 2001. The Panhandle now produces 10,000 acres of chickpeas and with 80 percent of U.S. chickpeas imported, there's room to grow.

Funding:

University of Nebraska Agricultural Research Division
Hatch Act
University of Nebraska Cooperative Extension
Smith Lever 3(b) & (c)
Nebraska Department of Agriculture Value-Added Program
SARE-USDA

Scope of Impact: Regional

Summary:

IANR's commitment to developing new crops for the Panhandle's arid, high plains climate is paying off for farmers and the region's economy. Scientists and Cooperative Extension staff have identified promising new higher-value crops and IANR studies provide critical information growers need to successfully plant, tend, harvest and market newcomers. These newcomers expand farmers' production options and add millions of dollars to the region's economy. For example, birdseed crops now grow on 250,000 Panhandle acres. Birdseed production is a $20 million a year industry, including processing plants that IANR staff helped attract to the region. Panhandle growers produce about 1,500 acres of grass seed annually valued at $1 million. The region's 900 acres of chicory, valued at $1 million annually, is processed at the nation's only chicory processing plant at Scottsbluff, which opened in 2001.

Category: Competitive Agricultural Systems in a Global Economy Greater Harmony Between Agriculture and the Environment

Key Theme: Agricultural Profitability

Impact Statement: Developing Dicamba-Tolerant Broadleaf Crops

(Relates to Nebraska Subgoal 1, Output Indicators 1 & 2, and Outcome Indicators 1 & 3)

Issue:

Dicamba, sold under trade names such as Banvel and Clarity, is widely used to control broadleaf weeds in corn, wheat and other grassy crops. But it's off-limits for broadleaf crops such as soybeans, vegetables and canola because it doesn't distinguish broadleaf good guys from bad guys in the field.

What has been done?

University of Nebraska biochemists discovered how to genetically modify broadleaf crops so they can tolerate dicamba spraying. The Institute of Agriculture and Natural Resources researchers identified a soil bacterium that easily breaks down dicamba and then isolated the gene responsible for dicamba inactivation. They devised a method for inserting this gene into tobacco, their model plant, and soybeans. Their experimental dicamba-tolerant soybeans withstood spraying at much higher-than-normal treatment rates. They also plan to work on developing other tolerant crops, such as canola and cotton. The university is patenting their technology.

Impact:

Dicamba-based herbicides are relatively inexpensive and easy on the environment because the chemical disappears quickly in plants and soil. Developing dicamba-tolerant broadleaf crops will make it easier for farmers to manage broadleaf weeds in these major crops and to make fewer trips across the field.

Funding:
University of Nebraska Agricultural Research Division
Hatch Act
Consortium for Plant Biotechnology Research
ConAgra
United AgriProducts

Scope of Impact: National

Summary:

Dicamba herbicide, sold under trade names such as Banvel and Clarity, has long helped control broadleaf weeds in corn, wheat and other grassy crops but it's been off-limits for broadleaf crops such as soybeans and vegetables. Discoveries by IANR biochemists are likely to change that. They have found a bacterial gene that basically instills herbicide resistance and developed a way to use it to genetically modify broadleaf crops so they can tolerate dicamba spraying. Their experimental dicamba-tolerant soybeans withstood spraying at much higher-than-normal application rates in field tests. The university is patenting their technique. These Nebraska discoveries eventually should allow farmers to use dicamba-based herbicides, which are inexpensive and environmentally benign, on broadleaf crops.

Category: Competitive Agriculture Systems in a Global Economy
Key Theme: Agricultural Profitability

Impact Statement: Developing Lighter Weight Replacement Heifers
(Relates to Nebraska Subgoal 1, Output Indicator 2, and Outcome Indicators 3 & 5)

Issue:

Feed is the single biggest cost for cow-calf operations. Anything that reduces feed expense without hurting the herd's performance improves the operation's bottom line.

What has been done?

Ranchers typically equate lighter weight replacement heifers with poor pregnancy rates and calving difficulty. However, University of Nebraska animal scientists found no difference in reproductive performance between spring-born replacement heifers developed to traditional and lighter weights. Ranchers typically develop replacement heifers to 60 percent or 65 percent of mature weight. This study found no reproductive differences in heifers developed to 53 percent and 58 percent of mature weight. Researchers tracked the lighter heifers through their fourth pregnancy and these cows remained lighter weight.

Impact:

This lighter weight approach significantly reduces costs during the heifer development period from fall weaning until the next summer's breeding season. Feeding heifers to 53 percent of mature

weight costs $22 per head less during the development period than feeding to traditional replacement weights. In a 500-cow operation with 15 percent of heifers replaced annually, that represents a $1,650 annual savings.

Funding:
University of Nebraska Agricultural Research Division
Hatch Act

Scope of Impact: Regional

Summary:

Feed is the biggest single cost for cow-calf producers. IANR animal science research shows that developing replacement heifers to lighter-than-traditional weights significantly reduces feed costs without hurting reproductive performance. Ranchers typically equate lighter-weight replacement heifers with poor pregnancy rates and calving difficulty but this research may change traditional thinking about weight requirements for young heifers. Traditionally, ranchers develop replacement heifers to 60 percent or 65 percent of mature weight. This three-year study found no reproductive problems or differences in heifers developed to 53 percent and 58 percent of mature weight. Feeding heifers to 53 percent of mature weight costs $22 per head less during the development period than feeding to traditional replacement weights. In a 500-cow operation with 15 percent of heifers replaced annually, that represents a $1,650 annual savings.

Federal Goal II. A Safe, Secure Food and Fiber System

Food animal production and food processing are major components of the Nebraska economy. The Nebraska Agricultural Research Division maintains a significant food safety research effort. Research faculty work closely with the food industry and regulatory agencies to focus research efforts of pre-harvest food safety areas, in particular, working with livestock producers.

The Nebraska goals under this federal goal are:

1. Animal and plant production systems and food processing and production systems to be enhanced to improve food safety and quality.
2. Research based information will increase awareness of consumers, producers, food processors, food handlers and extension personnel on food safety issues and technologies.

University of Nebraska veterinary scientists helped federal animal health officials assess the effectiveness of foot-and-mouth-testing tools. Nebraska scientists evaluated the effectiveness of commercial test kits used internationally to distinguish cattle vaccinated against foot-and-mouth from those infected with the disease. Foot-and-mouth is the world's most economically devastating livestock disease and it's estimated a U.S. outbreak would cost the economy billions.

Goal II Resources

Source of Funds	Federal*	State	All Other	Total
FY 2004 Expenditures ($ x 1,000)	$113	$1,329	$1,965	$3,407

Faculty SYs in FY 2004 - 11.1

* Includes Hatch, Multistate, McIntire-Stennis and Animal Health funds

Impact Statements Related to Federal Goal II - Identified by Key Themes

Category: Safe and Secure Food and Fiber Systems
Key Theme: Food Safety

Impact Statement: Evaluating Foot-and-Mouth Disease Tests
(Relates to Nebraska Subgoal 1, Output Indicator 2, and Outcome Indicator 1)

Issue:

No one wants to imagine the consequences of a foot-and-mouth disease outbreak in the United States. Yet in this era of heightened security concerns, officials also must prepare for an outbreak they hope never materializes – by accident or terrorism.

What has been done?

University of Nebraska veterinary scientists helped federal animal health officials assess the effectiveness of foot-and-mouth-testing tools. Nebraska scientists evaluated the effectiveness of commercial test kits used internationally to distinguish cattle vaccinated against foot-and-mouth from those infected with the disease. Such tests could be used after emergency vaccinations following an outbreak to see if cattle were exposed to the virus after vaccination. Nebraska veterinary scientists tested the kits in Argentina on samples collected during a real-life outbreak. This was the first comprehensive evaluation of these tests by U.S. scientists. Results identified differences among tests and were shared with federal animal health officials.

Impact:

Foot-and-mouth is the world's most economically devastating livestock disease and it's estimated a U.S. outbreak would cost the economy billions. Federal officials will use Nebraska's findings about test performance to improve biosecurity preparedness.

Funding:
USDA-Agricultural Research Service
University of Nebraska Agricultural Research Division
Hatch Act

Scope of Impact: National

Summary:

No one wants to imagine the consequences of a foot-and-mouth disease outbreak in the United States. Yet amid heightened security concerns, officials must prepare for an outbreak they hope never materializes – by accident or terrorism. IANR veterinary science research is helping federal animal health officials assess the effectiveness of foot-and-mouth-testing tools. Researchers evaluated the effectiveness of commercial test kits used internationally to distinguish cattle

vaccinated against foot-and-mouth from those infected with the disease. They tested the kits in Argentina on samples collected during a real-life outbreak. This international research was the first comprehensive evaluation of these tests by U.S. scientists and revealed differences among the tests.

Federal Goal III. A Healthy Well-Nourished Population

Enhancing the quality of life of individuals and families through healthy lifestyles including better nutrition and reduction of high risk activity is the Nebraska goal in this area. Particular areas of research emphasis include lipid metabolism, bioavailability of nutrients, eating behaviors and disorders, biochemistry of cardiac illnesses and functions of health care and family support systems. In addition to being incorporated in Cooperative Extension programs, research results are also used by a broad range of health care professionals, educators, and marketers and consumers of all ages.

A University of Nebraska nutrition scientist studied preschool-age children in Lincoln, Neb., to evaluate the National Academy of Sciences' dietary recommendation for vitamin E in children, which is 6 mg daily for 1- to 3-year-olds and 7 mg daily for 4- to 8-year-olds. She found the recommendations are appropriate. This study also revealed that two-thirds of pre-schoolers don't consume enough vitamin E and one-third don't get enough vitamin C. This research highlights the importance of preparing healthy snacks and meals that provide adequate vitamins to meet children's needs. Parents and day care providers can use this information to ensure children are consuming enough vitamins.

The above examples and the impact statement to follow identify the types of contributions being made by the Agricultural Research Division activities to Federal Goal III.

Goal III Resources

Source of Funds	Federal*	State	All Other	Total
FY 2004 Expenditures ($ x 1,000)	$69	$726	$842	$1,636

Faculty SYs in FY 2004 - 8.1

* Includes Hatch, Multistate, McIntire-Stennis and Animal Health funds

Impact Statements Related to Federal Goal III - Identified by Key Themes

Category: Healthy, Well-Nourished Population
Key Theme: Human Health

Impact Statement: Vitamin deficiency in Pre-schoolers
(Relates to Nebraska Subgoal 1, and Output Indicators 1 & 2, and Outcome Indicator 2)

Issue:

Getting enough key vitamins is important to good health, especially for children whose bodies are growing. Low-fat diets that many adults favor may leave children short on key fat-soluble vitamins.

What has been done?

A University of Nebraska nutrition scientist studied preschool-age children in Lincoln, Neb., to evaluate the National Academy of Sciences' dietary recommendation for vitamin E in children, which is 6 mg daily for 1- to 3-year-olds and 7 mg daily for 4- to 8-year-olds. She found the recommendations are appropriate. This study also revealed that two-thirds of pre-schoolers don't consume enough vitamin E and one-third don't get enough vitamin C. Interviews with parents about their children's dietary intake indicated that young children who share their parent's low-fat diet may get inadequate vitamin E. Based on this research, she recommends children regularly consume whole milk, nuts and seeds, regular salad dressings, and whole-grain cereals fortified with vitamins plus plenty of citrus fruits and juices for vitamin C.

Impact:

This research highlights the importance of preparing healthy snacks and meals that provide adequate vitamins to meet children's needs. Parents and day care providers can use this information to ensure children are consuming enough vitamins.

Funding:
University of Nebraska Agricultural Research Division
Hatch Act

Scope of Impact: National

Summary:

Some pre-schoolers aren't getting enough vitamins E and C, IANR research shows. A College of Education and Human Sciences nutrition scientist's study of Lincoln pre-school children found that two-thirds of these 2- to 5-year-olds don't consume enough vitamin E and one-third don't get enough vitamin C. Interviews with parents about their children's dietary intake indicated children who share their parent's low-fat diet often don't get enough vitamin E. Based on this research, this scientist recommends children regularly consume whole milk, nuts and seeds, regular salad

dressings, and whole-grain cereals fortified with vitamins plus plenty of citrus fruits and juices for vitamin C. Her findings highlight the important of healthy snacks and meals for children at home and in day care to ensure children get enough vitamins. She is expanding her study to include more children, especially in rural areas.

Federal Goal IV. To Achieve Greater Harmony (Balance) Between Agriculture and the Environment

Improvement of natural resources and environmental quality while maintaining a productive and profitable agricultural industry is on of three major themes in the Nebraska Agricultural Research Division Strategic Plan. Research activities in support of federal goal area IV have increased in recent years. The Nebraska goals are:

1. Improved environmental quality by conserving and enhancing air, soil and water resources.
2. Improved ecosystem management for sustained productivity and enhanced biodiversity.
3. Increased information and expertise on natural resources and environmental issues for facilitating policy development and successful implementation programs.

Farmers long have fertilized fields and pastures with livestock manure, which enriches soil and puts waste to good use. Today, manure may contain traces of antibiotics used in livestock production and there's growing interest in knowing what happens to antibiotics in the environment. To learn more about what happens to antibiotics in soil, University of Nebraska agricultural scientists teamed with a USDA Agricultural Research Service scientist and others on several years of field studies. Traces of oxytetracycline, an antibiotic commonly used in livestock, were detected in topsoil for 17 months after manure application.

New U.S. Environmental Protection Agency limits reduce the amount of arsenic allowed in drinking water from 50 to 10 parts per billion. More than 80 small public water systems across Nebraska could have trouble complying with this new federal requirement by the 2006 deadline because traditional cleanup methods are expensive. University of Nebraska-Lincoln water scientists are evaluating the occurrence of arsenic in the water supplies of small Nebraska communities to find ways to reduce arsenic in groundwater that cost less than drilling new wells or traditional approaches to removing the contaminant.

Goal IV Resources

Source of Funds	Federal*	State	All Other	Total
FY 2004 Expenditures ($ x 1,000)	$696	$7,091	$8,334	$16,121

Faculty SYs in FY 2004 - 45.4

* Includes Hatch, Multistate, McIntire-Stennis and Animal Health funds

Impact Statements Related to Federal Goal IV—Identified by Key themes

Category: Greater Harmony Between Agriculture and the Environment
Key Theme: Enhancing air, soil and water quality

Impact Statement: Understanding Antibiotic's Fate in Soil
(Relates to Nebraska Subgoal 1, Output Indicators 2 & 3, and Outcome Indicator 3)

Issue:

Farmers long have fertilized fields and pastures with livestock manure, which enriches soil and puts waste to good use. Today, manure may contain traces of antibiotics used in livestock production and there's growing interest in knowing what happens to antibiotics in the environment.

What has been done?

To learn more about what happens to antibiotics in soil, University of Nebraska agricultural scientists teamed with a USDA Agricultural Research Service scientist and others on several years of field studies. Traces of oxytetracycline, an antibiotic commonly used in livestock, were detected in topsoil for 17 months after manure application. Two years of testing found no oxytetracycline in water collected 8 feet under test plots. Manured plots also contained significantly more tetracycline-resistant bacteria in the topsoil than commercially fertilized plots for five months after application. Levels declined over time with no difference after five months. Further research is needed to determine whether the increase in resistant bacteria originates in the manure or develops in natural soil bacteria.

Impact:

Little has been known about the fate of antibiotic residues in soil. These results provide one of the first overviews of what happens when manure is applied to irrigated cropland. Findings lay the scientific foundation for further research to understand the potential health and environmental implications.

Funding:
University of Nebraska Agricultural Research Division
University of Nebraska Foundation
Hatch Act

Scope of Impact: Regional

Summary:

There's growing interest in the fate of antibiotics in the environment. IANR research is providing information about what happens to antibiotic residues in manure when it's applied to irrigated cropland. In field studies at North Platte, scientists detected traces of oxytetracycline, an antibiotic commonly used in livestock, in topsoil for 17 months after manure application. Manured plots contained significantly more tetracycline-resistant bacteria in the topsoil than commercially

fertilized plots for five months after application. Levels declined over time with no difference after five months. Scientists don't know whether the increase in resistant bacteria originates in the manure or develops in natural soil bacteria. There's much more to be learned but these findings lay the scientific foundation for further research to better understand potential health and environmental implications.

Category: Greater Harmony between Agriculture and the Environment
Key Theme: Water Quality

Impact Statement: Reducing or Eliminating Arsenic from Public Drinking Water Systems
(Relates to Nebraska Subgoal 1, Output Indicator 2, and Outcome Indicator 3)

Issue:

New U.S. Environmental Protection Agency limits reduce the amount of arsenic allowed in drinking water from 50 to 10 parts per billion. More than 80 small public water systems across Nebraska could have trouble complying with this new federal requirement by the 2006 deadline because traditional cleanup methods are expensive.

What has been done?

University of Nebraska-Lincoln water scientists are evaluating the occurrence of arsenic in the water supplies of small Nebraska communities to find ways to reduce arsenic in groundwater that cost less than drilling new wells or traditional approaches to removing the contaminant. Arsenic occurs naturally and is linked to some cancers and other health problems. One method scientists are considering is removing arsenic within the aquifer before pumping the water. This approach uses iron oxides, similar to rust, to attract and bond with the arsenic to remove it from the water. Researchers also are helping communities improve their well water sampling procedures to better assess arsenic levels in their water. The goal is to develop recommendations to help public water supplies meet the 2006 deadline.

Impact:

It's estimated that complying with the new EPA standard could easily total more than $120 million for small community water systems statewide if they use conventional methods to reduce arsenic levels. This Nebraska research should provide practical recommendations that could save small water systems thousands of dollars on arsenic cleanup costs.

Funding:

University of Nebraska Agricultural Research Division
U.S. Environmental Protection Agency
U.S. Geological Survey
Hatch Act

Scope of Impact: Regional

Summary:

University of Nebraska-Lincoln water scientists are working to help Nebraska's small communities meet a new, lower federal limit for arsenic in their drinking water. More than 80 small public water systems statewide could have trouble meeting the 2006 compliance deadline. Researchers are developing arsenic cleanup alternatives that cost less than drilling new wells or using traditional arsenic removal methods. The goal is to provide recommendations to help public water supplies meet the deadline. It's estimated that compliance using traditional methods could cost small water systems statewide more than $120 million. Results of this research could significantly reduce those costs. Researchers also are working to ensure local water system operators use well water sampling procedures that provide an accurate assessment of arsenic in their drinking water.

Federal Goal V. To Enhance Economic Opportunities and the Quality of Life Among Families and Communities

Nebraska's population has steadily shifted. Rural areas see declining populations relative to regional trade centers and metropolitan areas. These changes are leading to a decline in the number of young people in rural Nebraska. The impacts of these shifts on main street businesses and communities are dramatic in many cases.

Over the next 30 years, Nebraska's 65-and-older population is expected to nearly double. In addition to the aging population, other demographic changes include the increase in minority populations in Nebraska. Nutrition, health and wellness, including obesity, are critically important to Nebraskans. ARD research programs deal with policy issues as well as research to assist educational programs in these areas. The research programs are closely linked to Cooperative Extension educational programs. The specific Nebraska goals related to this area are:

1. Enhance basic life skills for Nebraska's children, youth and adults.
2. To enhance business and livable employment opportunities.

Rural communities face increasing challenges in maintaining diverse retail businesses that contribute to a healthy local economy. University of Nebraska agricultural economists have tracked retailing trends in Nebraska for 15 years by examining retail pull factors, which measure the relative strength of a community's retail sector. This research shows many rural communities are losing retail sales to larger towns and retailers because of population declines and greater mobility of consumers. Researchers identify communities and counties that defy this broader trend. Analysis of these successful rural retails provides insights about what might help other towns buck the trend.

Goal IV Resources

Source of Funds	Federal*	State	All Other	Total
FY 2004 Expenditures ($ x 1,000)	$90	$1,689	$2,220	$ 3,998

Faculty SYs in FY 2004 - 6.2

* Includes Hatch, Multistate, McIntire-Stennis and Animal Health funds

Impact Statements Related to Federal Goal V—Identified by Key Themes

Category: Economic Development and Quality of Life for People and Communities
Key Theme: Impact of Change on Rural Communities

Impact Statement: Retailing Pull Factor Research

(Relates to Nebraska Subgoal 3, Output Indicators 6 & 7, and Outcome Indicator 3)

Issue:

Rural communities face increasing challenges in maintaining diverse retail businesses that contribute to a healthy local economy.

What has been done?

University of Nebraska agricultural economists have tracked retailing trends in Nebraska for 15 years by examining retail pull factors, which measure the relative strength of a community's retail sector. This research shows many rural communities are losing retail sales to larger towns and retailers because of population declines and greater mobility of consumers. Researchers identify communities and counties that defy this broader trend. Analysis of these successful rural retails provides insights about what might help other towns buck the trend. For example, this research indicates maintaining a diverse mix of retail stores, working jointly to promote unique retail qualities, such as personal service and convenience, and focusing on niche markets can enhance retail sales.

Impact:

This long-term trend information helps rural communities better understand local retail strengths and weaknesses relative to other towns. Businesses and communities can use these findings to decide which strengths or qualities to emphasize through future marketing and investment.

Funding:

University of Nebraska-Lincoln Agricultural Research Division
Hatch Act

Scope of Impact: Regional

Summary:

Although larger urban areas continue to pull dollars away from Nebraska's small town retailers, collective and niche marketing can help smaller communities hold on to more dollars, according to IANR agricultural economic research. Researchers have analyzed pull factors, which measure the relative strength of a community's retail sector, for 15 years and concluded that some rural communities could enhance their retail sector by building strong leadership and maintaining a critical mass of businesses that are willing to work together and promote niche products. Communities can use these findings to better understand local retail strengths and weaknesses relative to other communities and to decide which strengths or qualities to emphasize through future marketing and investment.

B. Stakeholder Input Process

The processes used for stakeholder input for the Agricultural Research Division were described in detail in the initial ARD Plan of Work. Nebraska has had an extensive system of stakeholder input in place for many years. The Agricultural Research Division and the Cooperative Extension Division collaborate routinely in the planning and development of programs. These divisions, as part of the Institute of Agricultural and Natural Resources (IANR), have been partners in development of Strategic Plans for over 10 years.

a) Actions Taken to Seek Stakeholder Input

IANR conducted four listening sessions with approximately 120 Nebraskans in 2004. The sessions were held across the state. While the sessions were open to the general public, special invitations were made to ensure representation by underserved groups. The participants included limited resource audiences, ethnic minorities, state and local agency representatives, volunteer organization representatives, school officials, in-state clientele and out-of state stakeholders. The findings from the listening sessions have been reviewed with administrators and faculty. Both IANR and ARD's next five-year strategic plan is based on the results from the sessions.

Most IANR departments, research and extension centers, interdisciplinary centers and program areas have external advisory groups representing stakeholders and users. These groups meet at least annually and provide input on current and future programs of the units. The Agronomy Department Advisory Board has 25 members who meet twice annually. They provided information on strategic issues related to Agronomy and Horticulture teaching, research and extension. An Animal Science Department Advisory Committee was established in 2001 and has met several times. It has 27 members from various segments of the livestock, meat, and feed industry.

The Northeast Nebraska Experimental Farm Association serves as the stakeholder input group for the Northeast Research and Extension Center and Haskell Agricultural Laboratory. This group consists of representatives from each of the counties in the northeast district and meets annually to provide input on program needs at NEREC. Other research centers with advisory committees which meet annually include the High Plains Agricultural Lab and the Gudmundsen Sandhills Lab. Examples of programs which have advisory committee meetings which meet at least annually include the Republican River Basin Irrigation Management Demonstration Project and the *E. coli* 0157:H7 Food Safety Research Program.

b) Brief Statement of the Process Used by the Recipient Institution to Identify Individuals in Groups Who are Stakeholders and to Elicit Input from Them

The Animal Science Advisory Committee began by familiarizing members with the department's research, extension, and teaching programs. Currently, the Committee is providing input on future needs.

The Department of Nutrition and Health Science (formerly Nutritional Science and Dietetics) meets twice per year with its Community Nutrition Partnership Council. This Council helps to coordinate nutrition education for limited resource audiences. The members of the Council represent a broad group of state and local agencies, volunteer organizations, school officials, and others. They provide valuable input both on extension needs for Cooperative Extension and research needs for these types of programs.

The Department of Agricultural Economics advisory council consists stakeholders who help to provide perspectives on research and education needs at state, regional and national levels.

The Department of Agricultural Leadership, Education, and Communication's Advisory Council meets twice annually and consists of representatives from clientele groups throughout the state.

The above examples are only a part of the on-going stakeholder process. While the types of membership for these advisory groups vary, in all cases the intent is to have a membership selection process which allows for good representation from all clientele groups and rotation of membership to allow different views to be brought in.

c) A Statement of How Collected Input was Considered

In nearly every case with the examples of advisory groups mentioned above, minutes of meetings and reports are maintained and revisited periodically to see if programs are adjusted to respond to the recommendations. It is essential for active advisory groups to continue that the membership is able to review and reflect upon what impact a group has had in earlier recommendations. Stakeholder input has been valuable to units in making decisions on which programs to emphasize or initiate as well as which programs to de-emphasize. Stakeholder input is often critical in helping units and administrators make decisions on which areas are highest priorities for filling faculty positions. Since the filling of faculty positions is a critical element in refocusing programs, reaffirming priorities, or identifying emerging issues to address, the stakeholder input is very valuable in helping units and the Agricultural Research Division in making these decisions. The current five-year IANR Strategic Plan is based on the results of the listening sessions, reactions and input from the faculty and consideration of federal priorities.

C. Program Review Process

Nebraska has made no significant changes in program review processes since the 5-Year Plan of Work was submitted. The scientific peer review process used the by Agricultural Research Division as described in the 5-Year Plan of Work remains the same.

D. Evaluation of the Success of Multi and Joint Activities

1) Did the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

Critical issues of strategic importance identified by stakeholders are directly reflected in the IANR Strategic Plan. The Strategic Plan serves as a fundamental document which guides decision-making process on programs to emphasize and staffing decisions. ARD faculty currently participate in multi-state projects which are provided research funding support through the multistate research component of the Federal Formula Funds. These projects are selected and approved by regional Director Associations because they are high priority needs identified for multistate activity. A list of current ARD participation in multistate committees and the related federal goals is attached as Appendix 1.

2) Did the planned programs address the needs of under-served and under-represented populations of the state?

ARD research programs related to human nutrition and healthy lifestyles were highlighted under the federal goals and key themes. The results of this research feed science-based information directly into Cooperative Extension programs which target under-served and under-represented populations. Nutritional sciences research includes the project on evaluating the nutritional characteristics of meat from American bison. This is important because the growth, production and use of American bison as a healthy meat source is increasing and the fact that bison herds have been started on Nebraska's Native American reservations. A research project on assessing managerial and work force development in food service management is providing information useful for effective training of low income and minority populations working in the food service area.

3) Did the planned programs describe the expected outcomes and impacts?

Output and outcome indicators were described in the 5-Year Plan of Work submitted in 2000. The impacts of the example projects described in the accomplishments and results section relate directly to these output and outcome indicators.

4) Did the planned programs result in improved program effectiveness and/or efficiency?

Effective documentation of research programs, joint program output and outcomes, and ultimately impacts is an important part of our program activity. Individual faculty members are expected to identify outcomes and impacts in their annual faculty reports. The impact reports that are included in the accomplishment section of this report are developed for use by stakeholders and originate with the impacts identified by individual faculty annually. Having to document individual impacts, as well as interdisciplinary and joint program impacts keeps faculty focused on the need for productive programs.

The joint planning of multistate project activity results in less duplication and more cooperative program efforts. Many University of Nebraska IANR faculty have joint Agricultural Research Division and Cooperative Extension Division appointments. Therefore, joint planning is assured and this results in research programs that are directly related to Cooperative Extension's education needs. This arrangement definitely improved program effectiveness and/or efficiency.

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the 5-Year Plan of Work
for Multistate Extension Activities and Integrated Activities

Institution: **University of Nebraska Agricultural Experiment Station**
State: **Nebraska**
Check one: ____ Multistate Extension Activities
_X_ Integrated Activities (Hatch Act Funds)
____ Integrated Activities (Smith-Lever Act Funds)

		Estimated Costs				
	Title of Planned Program/Activity	**FY 2000**	**FY 2001**	**FY 2002**	**FY 2003**	**FY 2004**
Goal 1:	Integrated Crop Management Integrated Livestock Systems Management Integrated Pest Management Sustainable Agricultural Production Systems	$562,880	$633,823	$789,573	$789,573	$789,573
Goal 2:	Pre and Post Harvest Plant and Animal Food Safety Food Processing and Food Service Management Food Safety	$113,754	$81,427	$61,439	$61,439	$61,439
Goal 3:	Human Nutrition, Health and Safety Health Care	$21,645	$8,375	$16,052	$16,052	$16,052
Goal 4:	Natural Resources Management and Protection Environmental protection Environmental and Natural Resources Policy	$182,627	$299,047	$339,003	$339,003	$339,003
Goal 5:	Family Strengths Family Housing Telecommunications for Rural Areas Community Strengths	$130,934	$64,030	$40,727	$40,727	$40,727
Total		$1,011,840	$1,086,702	$1,246,794	$1,246,794	$1,246,794

Darrell W. Nelson
Dean and Director

April 1, 2005
Date

F. INTEGRATED RESEARCH AND EXTENSION ACTIVITIES

Below are a few examples of integrated Research and Extension activities.

Goal 1
Activity: Integrated Crop Management

Accurately dropping seeds into a row may seem routine but seeds can go astray in even the best planters. Improving the seed placement accuracy is critical to maximize yields and quality for most crops. University of Nebraska biological systems engineers are working to improve planter accuracy by identifying which planter components most affect seed placement. Using a sophisticated seed sensor one of the researchers invented, they found that wear on sugar beet planter seed tubes can cause seeds to hesitate, bounce or scatter, significantly altering seed placement. They found seed coatings can affect seed placement. They also used the sensor at Cooperative Extension clinics to measure accuracy and performance of sugar beet planters brought in by producers. This research has improved planter accuracy, which should improve yields and sugar beet quality. At extension clinics, the sensor showed that more than 90 percent of individual planter rows required replacement parts to achieve original seed spacing performance. Seed spacing accuracy was improved 19 percent on 69 planters tested and repaired in 2003. It is estimated this accuracy improved yields and reduced harvest loss by 1 ton per acre, resulting in an estimated $1.5 million additional income for growers in Nebraska, Colorado and Wyoming. The Extension education program using the research information has continued.

Activity: Integrated Livestock Management

Concerns over livestock odors are growing. Disputes often pit livestock producers against neighbors and sometimes divide communities. Finding science-based solutions to help minimize odors and conflicts is especially important in Nebraska, a leading livestock producing state. University of Nebraska biological systems engineers are developing a computer tool to predict how often there will be annoying odors in areas surrounding a livestock facility. Called the Nebraska Odor Footprint Tool, this software illustrates how far a livestock operation needs to be from neighbors in different directions to avoid odor-related conflicts. It incorporates weather records and livestock operation characteristics specific to Nebraska along with site-specific information. This tool will be used primarily to advise producers planning to expand existing facilities or build new ones. Cooperative Extension worked with livestock producers to test a prototype of the new tool at 2004 workshops. Researchers continue to enhance the tool and make it easier to use. The tool also will help planners and communities make more informed decisions about the placement of livestock operations. Researchers will test it in a rural community in the summer of 2005. The target is to make the tool available for general use by individuals in 2006. This tool should replace some of the emotion and guesswork often associated with decisions about where to locate livestock facilities with research-based information based on Nebraska and site-specific information. Better-informed choices about the location of livestock operations should reduce conflicts and improve environmental quality.

Activity: Integrated Pest Management

The soybean aphid arrived in the United States in 2000 and University of Nebraska entomologists began to prepare for its occurrence in Nebraska with research and education to help Nebraska producers respond to this new insect pest. Since the soybean aphid was new to North America and experience managing the insect was limited it was important to respond with an integrated research and extension education

program. Research at the Haskell Ag Laboratory has helped to refine and develop management recommendations for Nebraska conditions. The Nebraska Soybean Board provided funding for the soybean aphid research and the development of educational materials including a 2004 Cooperative Extension NebFact on Soybean Aphid Management in Nebraska. The research effort began in 2000 with surveys to provide early detection if the aphid occurred in Nebraska, fortunately none were detected. The surveys continued in 2001 and 2002 to document the aphid's distribution and possible spread. These surveys were critical in documenting the aphid's first occurrence in Nebraska in 2002. This overall survey effort and early warning program identified regions in Nebraska with the early season aphid colonization of soybean, established survey circuits in Eastern Nebraska for aphids on overwintering hosts and soybean fields, alerted farmers upon the earliest appearance of the aphid, and disseminate the most recent aphid biology and management information. Other research in collaboration with the University of Minnesota addressed the physiological responses of soybean to aphid injury; this information is instrumental to the development of improved economic thresholds and aphid management strategies. Producers were provided up-to-date information on the occurrence of the aphid, scouting recommendations, economic threshold information, and recommended management strategies using a variety of tools. Key newsletters like "Crop Watch" and the "Northeast Integrated Pest Management and Cropland Production Newsletter" along with numerous news releases to the media kept producers informed. Information was also provided in numerous summer field days and winter education programs for both producers and agri-business professionals. The proactive research and education program has prevented wide spread economic damage to Nebraska's soybean crop in 2003 and 2004.

Activity: Sustainable Agriculture Production Systems

Alternative, higher-value crops can broaden crop options for farmers and bolster regional economies, but new crops also are risky. Farmers need information about producing unfamiliar crops under local conditions as well as their market potential. University of Nebraska agricultural scientists and Cooperative Extension staff have identified and are educating producers about promising alternative crops for the Nebraska Panhandle's arid high plains climate. The effort focuses on alternatives with higher value potential for growers and the region's economy. Studies have revealed how best to plant, manage and harvest several new crops. Scientists identify existing varieties best suited to local growing conditions or breed new varieties for the region and explore a new crop's market potential. New crops being grown in the Panhandle as a result of these efforts include: proso and foxtail millet and sunflowers for birdseed; chickpeas for human food; turf and forage grass seed, and chicory. Brown mustard and canola for environmentally friendly biodiesel production are among the latest crops being studied. New crops have expanded farmers' production options and added millions of dollars to the region's economy. Birdseed crops now grow on 250,000 Panhandle acres and birdseed production is a $20 million a year industry, including several processing plants that extension staff helped attract to the region. Panhandle growers produce about 1,500 acres of grass seed valued at $1 million annually. The region's 900 acres of chicory, valued at $1 million annually, are processed at the nation's only chicory processing plant at Scottsbluff, which opened in 2001. The Panhandle now produces 10,000 acres of chickpeas and with 80 percent of U.S. chickpeas imported, there's room to grow.

Goal 2

Activity: Food Processing and Food Service Management Food Safety

For the 6 million to 7 million Americans with food allergies, grocery shopping can be time-consuming and a bit scary. To avoid potentially deadly allergic reactions, they must scrutinize food labels. Even that sometimes isn't enough. Foods manufactured on shared equipment sometimes inadvertently contain ingredients that aren't on the label. Research by food toxicologists in the University of Nebraska's internationally recognized Food Allergy Research and Resource Program produced fast, simple, accurate tests food processors can use to check for traces of allergenic foods on food or equipment. The Nebraska-developed tests for peanut, eggs, almonds and milk are commercially available; others are in the works. The team provides extension education for food manufacturers on broad food allergy issues, including labeling laws, recalls, allergen controls and using test kits. Two-day sessions attract industry representatives from across North America and also have been offered internationally. Food allergies are a worldwide health concern and cause as many as 200 deaths and countless allergic reactions each year in the United States alone. The Nebraska-developed tests and training are helping the food industry protect allergic consumers and reduce product recalls. The 30-minute tests replace procedures that took days to complete in a laboratory. Companies that use the tests can be confident that their products contain only the ingredients listed on the label. Training sessions also pay off. Thanks to what they learned at one session, 100 industry representatives changed a manufacturing practice and estimated avoiding potential recall costs averaging $500,000 each.

Goal 3

Activities: Human Nutrition, Health and Safety and Health Care

Fruit and Vegetable Connection Project

Nebraska is participating as one of ten states in a multi-state research and extension project that was funded by USDA. Over the course of two years, three rounds of interviews were conducted with 1200 low-income young adults between 18 and 24 (198 young adults in Nebraska). Approximately half of the group received phone calls and educational materials that were tailored to their readiness for making changes in fruit and vegetable intake. The other half received a standard pamphlet and no personal phone contact. Results have indicated that the tailored group progressed in their ability to eat more servings of fruits and vegetables in a day. In each state, including Nebraska, extension personnel were trained in recruiting techniques and making the educational phone calls. A cost analysis of reaching audiences via educational phone call versus individual or group face-to-face contact is being conducted In addition a satisfaction survey with the educators who conducted the educational phone calls has been conducted and results are being compiled. Both procedures will allow some determinations about the implications for the applicability of this educational delivery method for additional extension programs.

Wellness for Women

Nebraska Cooperative Extension is cooperating with the University of Nebraska Medical Center on a nutrition and physical activity behavior change research project that targets 50-69 year old women living in rural parts of the state. The project was funded by National Institutes of Health/National Institute of Nursing Research. Two hundred twenty-five women were recruited for the study beginning in September 2002. Half of the women received tailored newsletters based on their responses to eating and phyical activity questionnaires and physical measures. The other half received generic messages about nutrition and physical activity. Nebraska Extension personnel participated in the development of the

educational messages for the nutrition content and in the analysis of nutrition/eating behavior results. The project has been able to highlight implications for reaching rural, harder-to-reach audiences with health information that will assist them in making behavior changes. Additional work is being proposed to determine effectiveness for reaching the audiences using tailored messages that are delivered electronically rather than mailed format.

Goal 4

Activity: Natural Resources Management and Protection

Everyone loves a lush lawn but traditional turfgrass usually requires lots of water, chemicals and maintenance. Two decades of University of Nebraska turf science research has transformed buffalograss, a tough, drought-tolerant prairie grass, into improved water-thrifty grass well-suited for lawns, golf courses, parks and other turf. Nebraska is the nation's leader in turf buffalograss research and improvement. Since 1990, nine turf buffalograsses developed by Institute of Agriculture and Natural Resources scientists have been commercialized. Buffalograss requires up to 50 percent less water than Kentucky bluegrass and far less mowing and fertilizer and pesticide application. The Extension turf work group has provided education for homeowners and professional turf grass managers on the use and management of buffalograss in Nebraska's environment. This effort has included publications on selection, planting and maintenance of buffalograss. Demand for these grasses is growing nationwide, but especially in areas hardest hit by drought and water shortages. The improved varieties of buffalograss not only help protect the environment and use less of limited water supplies, but also are also more aesthetically pleasing.

Activity: Environmental Protection

<u>On-the-go Sensors for Precision Ag</u>

The more farmers know about their soil, the better for their profits and the environment. Precision agriculture tools can provide site-specific information farmers need to better match crop nutrient needs to varying soil conditions. University of Nebraska biological systems engineers are developing and testing soil sensors to help farmers better assess physical and chemical characteristics of soil across a given field. The sensors are being designed to detect and map soil properties on-the-go, as they are pulled across fields. These new sensors provide more precise information and should cost less than conventional methods of gathering this information, such as extensive soil sampling of fields. Some of this technology already has been patented and commercialized. Information on the existing technology and updates on the research have been part of Extension educational programs on precision agriculture delivered by the Extension precision agriculture work group. On-the-go sensors will more accurately detect physical and chemical soil characteristics across a field and provide cheaper, more accurate information than traditional soil sampling. Farmers can use this information to make better crop and soil management decisions. Ultimately, farmers will be able to more precisely match crop needs to varying local conditions, which should result in more effective use of agricultural chemicals and protection of the environment, particularly water quality protection.

Activity: Environmental and Natural Resources Policy

New U.S. Environmental Protection Agency limits reduce the amount of arsenic allowed in public drinking water supplies from 50 to 10 parts per billion. More than 80 small public water systems across Nebraska could have trouble complying with this new federal requirement by the 2006 deadline because traditional cleanup methods are expensive. In addition, many private water supplies with wells in the same aquifers as the small communities will also have elevated arsenic levels. University of Nebraska-Lincoln water scientists are evaluating the occurrence of arsenic in the water supplies of small Nebraska communities to find ways to reduce arsenic in groundwater that cost less than drilling new wells or traditional approaches to removing the contaminant. Arsenic occurs naturally and is linked to some cancers and other health problems. One method scientists are considering is removing arsenic within the aquifer before pumping the water. This approach uses iron oxides, similar to rust, to attract and bond with the arsenic to remove it from the water. Researchers also are helping communities improve their well water sampling procedures to better assess arsenic levels in their water. The goal is to develop recommendations to help public water supplies meet the 2006 deadline. The survey of arsenic levels that has been part of the research has provided input to the development of an Extension publication that provides information for both individuals using water from a public water supply or a private supply. The publication provides basic background information, potential health effects, sampling and testing, interpretation of test results, and options if desired arsenic levels are exceeded. Cooperative Extension has cooperated with the University of Nebraska Public Policy Center in a project working with a small community to develop options to respond to arsenic levels above the EPA maximum contaminant level. It's estimated that complying with the new EPA standard could easily total more than $120 million for small community water systems statewide if they use conventional methods to reduce arsenic levels. This Nebraska research and education program should provide practical recommendations that could save small water systems and individuals well owners thousands of dollars on arsenic cleanup costs.

Goal 5

Activity: Family Strengths

<u>Quality Interventions for Early Childhood Education (QUINCE): A Collaborative Consultation Model</u>
The University of Nebraska-Lincoln is one of five partners (North Carolina, Iowa, Minnesota, and California) in the Quality Interventions for Early Childhood Education (QUINCE) research project. The focus of this project is to use a quantitative methodology to test the effectiveness of the Partners for Inclusion model (a collaborative consultation method) for improving the quality of child care.

Nebraska Cooperative Extension staff are working with researchers and other Extension staff from the five partnering states to collect pre- and post-test data, provide intervention and analyze results. Following baseline data collection, trained Cooperative Extension staff work directly with at-home child care providers to complete the Family Day Care Rating Scale (FDCRS), and discuss their ratings. The FDCRS is used as a tool to further evaluate the strengths, needs, and resources of the program. When the provider feels that the goals on the action plan have been accomplished, the consultant and provider re-evaluate the program and the consultant prepares a final report for the provider that celebrates the successes. Post-test surveys are used to assess differences in the quality of the child care environment as a result of the intervention. Forty child providers participated in 2004-2005. Beginning in August, 2005, a second group of eighty providers will be recruited to participate.

Business Networks and Rural Community Economic Vitality, a USDA Fund for Rural America project
Researchers from Iowa State University, and the University of Nebraska-Lincoln studied 29 enduring and non-enduring business networks to determine what characteristics are associated with enduring networks. Additionally, representative members of each of the networks (n=1122) were surveyed to determine characteristics of those who belong to networks. A second phase of this project was to form five new business networks in Iowa, Nebraska and Ohio. In Nebraska, the research and extension members of the team visited all women's specialty stores in the state located in communities between 2,500 and 10,000 population. During initial visits, the concept of a specialty store network was discussed with store owners. Subsequently, twelve store owners from across the state indicated an interest in forming a new network. Owners of six of the twelve stores have met three times in Kearney, Nebraska, at a time coinciding with the Kearney Apparel Mart. (Although other store owners are interested in the network, they do not go to Kearney for market, and therefore did not attend any of the meetings.) The six stores have formed a new association, the Nebraska Apparel Store Association. University of Nebraska faculty (members of the research/extension team) have facilitated each of the meetings, provided educational sessions for the meetings and oversee a graduate student who is in charge of the association's newsletter. A final stage is the creation of train-the-trainer modules which will provide in-depth instruction in network development based on research findings and the experience of network creation.

Activity: Community Strengths

Retailing Pull Factors
Although larger urban areas continue to pull dollars away from Nebraska's small town retailers, collective and niche marketing can help smaller communities hold on to more dollars, according to IANR agricultural economic research. Researchers have analyzed pull factors, which measure the relative strength of a community's retail sector, for 15 years and concluded that some rural communities could enhance their retail sector by building strong leadership and maintaining a critical mass of businesses that are willing to work together and promote niche products. Communities can use these findings to better understand local retail strengths and weaknesses relative to other communities and to decide which strengths or qualities to emphasize through future marketing and investment.

Cooperative Extension builds on the pull factor research with its Consumer Preference and Economic Leadage program with surveys and education to explore factors that influence consumer preferences and shopping decisions. Most participating business owners indicate that these studies are very beneficial. As a result of participating, many have made or are in the process of making changes in their business to improve profitability. The Consumer Preference part of the program explores factors that affect local consumers' shopping decisions. Local consumers describe their preferences, offer opinions about business strengths and make suggestions for improvement. These consumers also provide impressions of the general shopping environment that have an impact on economic leakage. Since 1997, studies and education programs have been completed in 28 communities across Nebraska and Colorado, including over 600 businesses and 600 consumers.

Appendix I

Multi-State Research Committees with Current Agricultural Research Division Faculty Participation

No.	Title	Participating Unit *	Federal Goal
NRSP-1	Research planning using the Current Research Information System (CRIS)	Administration	N/A
NRSP-3	The National Atmospheric Deposition Program (NADP) - A long-term monitoring program in support of research effects of atmospheric deposition	Administration	N/A
NRSP-4	High Speciality Crop Pest Management	Entomology	1
NRSP-8	National Animal Genome Research Project	Animal Science	1
NC-7	Conservation, Management, Enhancement and Utilization of Plant Genetic Resources	Agron/Hort PREC	1
NC-100	Regional Research Coordination, N C Region	Administration	NA
NC-107	Evolving Pathogens, Targeted Sequences, and Strategies for Control of Bovine Respiratory Disease	VBS	1
NC-125	Biological Control of Soil- and Residue-borne Plant Pathogens	Plant Path	1
NC-129	Mycotoxins in Cereal Grains	Plant Path	2
NC-131	Molecular Mechanisms Regulating Skeletal Muscle Growth and Differentiation	An Sci	1
NC-136	Improvement of Thermal and Alternative Processes for Foods	IAPC	2
NC-170	Mediating Exposure to Environmental Hazards through Textile Systems	TCD	1
NC-202	Characterizing weed population variability for improved weed management decision support systems to reduce herbicide use	Agron/Hort	4
NC-205	Ecology and Management of European Corn Borer and other Stalk-boring Lepidoptera	NEREC Ent	1
NC-213	Marketing and Delivery of Quality Cereals and Oilseeds	FS&T Agron/Hort	1

No.	Title	Participating Unit *	Federal Goal
NC-218	Assessing Nitrogen Mineralization and other Diagnostic Criteria to Refine Nitrogen Rates for Crops and Minimize Losses	Agron/Hort	1
NC-219	Using Stage Based Intervention to Increase Fruit and Vegetable Intake in Young Adults	Nutr	3
NC-229	Porcine Reproductive & Respiratory Syndrome (PRRS): Mechanisms of Disease and Methods for the Detection, Protection and Elimination of PRRS Virus	VBS	1
NC-230	Integrating Biophysical Functions of Riparian Systems with Management Practices and Policies	BSE	4
NC-1003	Impact analysis and decision strategies for agricultural research	Ag Econ	1
NC-1004	Genetic and Functional Genomic Approaches to Improve Production Quality of Pork	An Sci	1
NC-1005	Landscape Ecology of White-tailed Deer in Agro-forest Ecosystems: a Cooperative approach to Support Management	SNRS	4
NC-1007	Enteric Diseases of Swine and Cattle Prevention Control and Food	VBS	1
NC-1011	Rural low-income families: Tracking their well-being and function in an era of welfare reform	FCS	5
NC-1016	Economic assessment of changes in trade arrangements, bio-terrorism threats and renewable fuels requirements on the U S Grain and Oilseed sector	Ag Econ	2
NC-1018	Impact of climate and soil on crop selection and management	SNR	4
NC-1020	Beef cattle grazing systems that improve production and profitability while minimizing risk and environmental impacts	An Sci	1
NC-1021	Nitrogen cycling, loading and use efficiency in forage-based livestock production systems	Agron/Hort	4
NC-1022	The chemical and physical nature of particulate matter affecting air, water and soil quality	SNR	4

No.	Title	Participating Unit *	Federal Goal
NC-1100	North Central Regional Center for Rural Development	Ag Econ	5
NC-1119	Management Systems to improve the economic and environmental sustainability of dairy enterprises	Ag Econ	1
NC-1142	Regulation of Photosynthetic Processes	Biochem	1
NC-1167	N–3 Polyunsaturated Fatty Acids and Human Health and Disease	Nutr	3
NCAC-1	Crop Soil Research	Agro/H	NA
NCAC-2	Animal Health Advisory Committee	VBS	NA
NCAC-4	Horticultural Crops	Agro/H	NA
NCAC-5	Human Sciences	Home Ec	NA
NCAC-6	Livestock Production	An Sci	NA
NCAC-10	Forestry and Forest Products	SNRS	NA
NCAC-12	Agricultural Economics	Ag Econ	NA
NCAC-14	Plant Pathology	Plant Path	NA
NCAC-15	Entomology and Economic Zoology	Ent	NA
NCAC-16	Agricultural Engineering	BSE	NA
NCAC-22	Food Science and Human Nutrition	FS&T, Nutr	NA
NCAC-23	Fisheries and Wildlife	SNRS	NA
NCAC-24	Agricultural Education Research	AgLEC	NA
NCCC-22	Small Fruit and Viticulture Research	Agron/Hort	1
NCCC-42	Committee on Swine Nutrition	An Sci	1
NCCC-52	Family Economics	FCS	5
NCDC-201	Nanotechnology and Biosensors	IAPC	2
NCDC-203	Obesity Initiative	NHS	3
NCDC-204	Biological control of plant pathogens in the North Central Region	Agron/Hort	4
NCDC-205	Development of pest management strategies for forage alfalfa persistence	Ento	4
NCDC-206	Impact of changing management systems on soil nematode communities	Plant Path	4

No.	Title	Participating Unit *	Federal Goal
NCERA-59	Soil organic matter: Formation, function and management	Agron/Hort	4
NCERA-89	Swine management research committee	NEREC	1
NCERA-103	Specialized soil amendments and products, growth stimulants and soil fertility management programs	Agron/Hort	4
NCERA-125	Biological control of arthropods and weeds	Entom	4
NCERA-180	Site-specific management	Agron/Hort	1
NCERA-184	Management of small grain diseases	Plant Path	1
NCERA-194	Improving the management and effectiveness of cooperatively owned business organizations	Ag Econ	1
NCERA-199	Implementation and strategies for National Beef Cattle evaluation	Statistics	1
NCERA-200	Management strategies to control major soybean virus diseases in the North Central Region	Plant Path	4
NCR-3	Soil Survey	SNR	1
NCR-9	Midwest Plan Service- Research and extension educational materials	NEREC BSE	1
NCR-13	Soil Testing and Plant Analysis	Agro/H	1
NCR-31	Ecophysiological Aspects of Forage Management	Agro/H	1
NCR-46	Development, Optimization, and Delivery of Management Strategies for Corn Rootworms	Ent	1
NCR-57	Reproductive Physiology	An Sci	1
NCR-65	Social Change in the Market Place: Consumer/Retail/Producer Interface	TCD	5
NCR-84	Potato Breeding and Genetics Technical Committee	Agro/H	1
NCR-87	Beef Cow-Calf Nutrition and Management	An Sci	1
NCR-97	Regulation of Adipose Tissue Accretion in Meat Animals	An Sci	1
NCR-125	Biological Control of Arthropod Pests	SCREC Ent	4
NCR-131	Animal Care and Behavior	AnSci	1

No.	Title	Participating Unit *	Federal Goal
NCR-137	Soybean Diseases	Plant Path	4
NCR-148	Migration and Dispersal of Agriculturally Important Biotic	Ent	1
NCR-167	North Central Regional Corn Breeding Research Committee	Agro/H	1
NCR-170	Research Advances in Agricultural Statisticians	Biometry	1
NCR-173	Biochemistry and Genetics of Plant-Fungal Interactions	Plant Path	1
NCR-174	Synchrotron X-ray Sources in Soil Science Research	SNRS	1
NCR-189	Air Quality Issues Associated with Animal Facilities	BSE	4
NCR-192	North Central Regional Turfgrass	Agro/H	1
NCR-193	Maintaining Plant Health: Managing Insect Pests and Diseases of Landscape Plants	SNRS	1
NCR-201	Integrated Pest Management	Agro/Hort Ent	1
NCR-202	Health and Survival of Honey Bee Colonies	Ent	1
NCR-203	Impact of Human Capital Development on the Quality of Rural Community Life	AgLec	5
NCR-204	The Interface of Molecular and Quantitative Genetics in Plant and Animal Breeding	Agro/H	1
NCR-206	Nutrition and Management of Feedlot Cattle to Optimize Performance, Carcass Value and Environmental Capability	An Sci	1
NE-1010	Forage Crop Genetics and Breeding to Improve Yield and Quality	Agro/H	1
NE-1017	Localized environment control and plant fertigation	BSE	4
NE-1022	Biophysical models for poultry production systems	An Sci	1
S-295	Enhancing Food Safety Through Control of Food-Borne Disease Agents	FS&T	2

No.	Title	Participating Unit *	Federal Goal
S-1002	New Technologies for Utilization of Textile Materials	TC&D	3
S-1005	Sources, Dispersal and Management of Stable Flies on Grazing Beef and Dairy Cattle	Ent WCREC	1
S-1007	Science and Engineering for a Biobased Industry and Economy	BSE	1
S-1008	Genetic Selection and Crossbreeding to Enhance Reproduction and Survival of Dairy Cattle	An Sci	1
S-1010	Dynamic Soybean Pest Management for Evolving Agricultural Technologies and Cropping Systems	Ent	1
W-112	Reproductive Performance in Domestic Ruminants	An Sci	1
W-150	Genetic Improvement of Beans (Phaseolus vulgaris L.) for Yield, Disease Resistance and Food Value	Agron/Hort	1
W-173	Stress Factors of Farm Animals and Their Effects on Performance	Biometry	1
W-1002	Nutrient Bioavailability -Phytonutrients and Beyond	Nutr	3
W-1177	Enhancing the Global Competitiveness of U S Red Meat	PREC An Sci	1
W-1186	Genetic Variability in the Cyst and Root Knot Nematodes	Plant Path	1
W-190	Agricultural Water Management Technologies, Institutions and Policies Affecting Economic Viability and Environmental Quality	Ag Econ	4
WCC-11	Turfgrass Research	Agron/Hort	1
WCC-55	Rangeland Resource Economics and Policy	Ag Econ	1
WCC-60	Science and Management of Pesticide Resistance	Ent	1
WCC-66	Integrated Management of Russian Wheat Aphid and Other Cereal Aphids	PREC Ent	1
WCC–97	Research on Diseases of Cereals	Plant Path	1
WCC-203	Animal Utilization of Products from Processing Agricultural Commodities	An Sci	1

* Unit Abbreviations

Ag Econ	Agricultural Economics
AgLEC	Agricultural Leadership, Education and Communication
Agro/H	Agronomy and Horticulture
An Sci	Animal Science
Biochem	Biochemistry
BSE	Biological Systems Engineering
Biometry	Biometry
Ent	Entomology
FCS	Family and Consumer Science
FS&T	Food Science and Technology
IAPC	Industrial Ag Products Center
Nutr	Nutritional and Health Sciences
Plant Path	Plant Pathology
SNRS	School of Natural Resource Sciences
TCD	Textiles, Clothing and Design
VBS	Veterinary and Biomedical Sciences
NEREC	Northeast Research and Extension Center
PREC	Panhandle Research and Extension Center
SCREC	South Central Research and Extension Center
WCREC	West Central Research and Extension Center