

**ANNUAL REPORT
DICKINSON RESEARCH EXTENSION CENTER
1993-1994**

**K.A. Ringwall
Director**

GOALS:

The Dickinson Research Extension Center shall conduct research on increasing the carrying capacity of native rangeland, with emphasis on conservation and preservation for future generations. The center shall conduct research on grass production to determine how to best compensate for the weather as it influences production in the dryland agriculture of western North Dakota. The center shall conduct research with beef cattle and swine breeding, feeding, management, and disease control for the benefit of livestock producers of western North Dakota and the entire state. The center shall conduct research designed to increase productivity of all agricultural products of the soil in the dryland agricultural region of southwestern North Dakota by the identification of adapted crop species and superior crop cultivars; and development of profitable cropping systems that achieve the necessary balance between profitability and conservation of all natural resources. The center shall disseminate research and extension results and information for the benefit of this state.

Presently, the Dickinson Research Extension Center (DREC) is integrating scientists from different backgrounds and disciplines to best serve the needs of southwestern North Dakota agriculture. The center is initiating system-oriented, value-added research projects requested by farmers and ranchers. Close working relationships are being fostered between NDSU Agricultural Experiment Station and Extension Service personnel. Research Extension Center scientists are also teaching and advising present and future North Dakota farmers and ranchers.

The Dickinson Research Extension Center is unique in having animal, crop, and range scientists represented among the professional staff. The scientific diversity has provided for a broad perspective in evaluating the agricultural systems in the southwest. This is reflected in the 15 research projects and 51 objectives currently at the DREC. The diversity of background and training allows for varied responsibilities being assigned to the professional staff. Two scientists have joint NDSU Agricultural Experiment Station and Extension Service appointments, and three scientists are involved in teaching and advising at Dickinson State University.

The Dickinson Research Extension Center has a threefold mission: grassland research and extension, livestock research and extension, and research and extension in agronomy. The faculty and staff which has been assembled is capable of meeting the needs, as well as in forging new directions in agricultural research and working for an invigorated, profitable agriculture in the southwest. Current research personnel include the following principle investigators: Patrick Carr, Ph.D., Douglas Landblom, M.S., Lee Manske, Ph.D., James Nelson, B.S., Kris Ringwall, Ph.D., Donald Nordby, M.S., Area Livestock Specialist, and support staff: Dave Bartow, Agricultural Research Technician II, Jeffrey Kubik, Agricultural Research Technician II, Glenn Martin, Research Specialist II, Burt Melchior, Agricultural Research Technician II, Jane Olheiser, Administrative Secretary II, Gary Ottmar, Agricultural Research Technician II, Robert Paluck, Agricultural Research Technician II, Philip Berg, Research Specialist II, Lee Tisor, Agricultural Research Technician III, and Paula Riehl, Administrative Secretary II.

CONTINUING AND NEW INITIATIVES:

The past year has been one of continued reorganization to prepare for meeting the educational and research needs of the total agricultural community. The reorganization required re-tooling of existing educational research structures. The consortium that was formed to support post secondary and adult curriculum based education through a team oriented approach to agricultural education and research in southwestern North Dakota is functioning well. This consortium established educational goals and curriculum which will enhance an individual's ability to make sound agricultural career and enterprise decisions. The consortium has allowed direct input for enhanced research goals which address the present needs, as well as forging new directions, to make agricultural business and production profitable in the southwest. Currently, the North Dakota University System serves agriculture in southwestern North Dakota through the NDSU Extension Service, North Dakota Agricultural Experiment Station and Dickinson State University Agriculture Department. The consortium integrates North Dakota State University and Dickinson State University faculty and staff to best serve the North Dakota University System's agricultural education and research needs of southwestern North Dakota.

The following research efforts were developed as a result of extensive review and reorganization of past efforts of the Dickinson Research Center. Enclosed is a short summary of new and future research and extension efforts of the Dickinson Research Extension Center.

Project: Wheat Production Systems for Southwestern North Dakota

1. Determine if a cultivar by seeding rate interaction exists across wheat-black fallow, wheat-ecofallow, and wheat-chemical fallow systems.
2. Evaluate N fertilizer and N fertilizer by fungicide interactions for tan spot suppression, grain yield and phenotypic response in a continuous wheat monoculture across conventional-, reduced-, and no-tillage environments.
3. Compare the agronomic performance of several spring wheat cultivars across wheat-black fallow, wheat-wheat and wheat-corn rotations.
4. Determine the agronomic and economic potential of substituting legume and nonlegume green manure crops for black fallow in a rotation with wheat.

Project: Small Grain Crops in Southwestern North Dakota

1. Evaluate genotypes of hard red spring wheat, durum wheat, winter wheat, barley, and oats in southwestern North Dakota.
2. Evaluate rye, triticale, millet, emmer wheat, speltz wheat, polish wheat, intermediate wheatgrass, and perennial wildrye as food and/or feed grain crops.

Project: Alternative Crops and Cropping Systems in Southwestern North Dakota

1. Evaluate corn and pulse crops alone and in mixtures with one another and small grains for feed and forage in southwestern North Dakota.
2. Investigate several plant species as new industrial oilseed crops.
3. Explore weed control strategies among alternative crops.

Project: Breeding and genetics of spring barley

1. To develop improved spring barley cultivars for North Dakota and adjacent regions.
2. To evaluate agronomic practices for improving barley production.
3. To determine the inheritance of selected agronomic traits, resistance to pathogens, and quality factors.
4. To maintain and improve genetic stocks.

Project: Hard Red Winter Wheat Improvement

1. Develop improved winter wheat cultivars for North Dakota.
2. Identify desirable genetic variability and study selection techniques to incorporate it into northern hard red winter wheat germplasm.
3. Develop production systems and technologies that would result in improved survival of winter wheat cultivars.

Project: Amending Eroded Soils with Manure for Restoration of Productivity

1. To evaluate the effectiveness of manure for restoring productivity to eroded soils.
2. To evaluate quantities of manure required.
3. To evaluate the effects of manure on soil physical and chemical characteristics.

Project: Nutritional Relationships for Sow Productivity and Lean Growth

1. To determine the effect of dietary energy intake during gestation on sow body condition, lactation weight change, and litter and rebreeding performance.
2. To determine the effect of modifying lysine to energy ratios during lactation on sow body condition, lactation weight change, and litter and rebreeding performance.
3. To determine the effect of protein and lysine-energy ratio modifications on performance and carcass merit of growing-finishing pigs.

Project: Defoliation Effects on the Structure and Dynamics of Grassland Ecosystems

1. Determine the impacts that defoliation by grazing, and mowing, have on grassland plant species composition and biomass.
2. Determine the optimum season of use for domesticated grass pastures and native range based on plant phenology, tiller development, and livestock requirements and performance.

Project: Field Evaluation of Woody Plant Materials

1. Conduct evaluation studies to determine the adaptation and performance of woody plant materials for conservation purposes.
2. Conduct advanced evaluation and progeny testing of selected strains of woody plant materials.
3. Establish seed and plant increase of selected accessions.
4. Develop and release improved plant materials for public use.

Project: Evaluation of Woody Plant Materials for Use in North Dakota

1. Evaluate new cultivars, clones or exotic species of woody tree and shrub materials for hardiness, establishment success, growth rate, vigor and potential for shelterbelt and/or ornamental use.
2. Compare the adaptability and performance of these woody plants over a wide range of climatic and soil conditions.
3. Provide a pool of germplasm for additional selection and testing.
4. Provide performance data on woody plants tested to support the development of a recommended list of woody species and/or cultivars for planting in North Dakota.

Project: Evaluation of Shelterbelt Renovation Alternatives

1. Evaluate tree thinning methods of volunteer trees and/or natural regeneration.
2. Investigate interplanting of younger trees between existing rows of mature shelterbelts.
3. Evaluate the effect of grass and weed competition with the re-establishment of interplanted trees and shrubs.
4. Compare different techniques of dead tree removal and utilization of tree by-products in re-establishment.

Project: Integrate Annual-Perennial Forage Systems for Livestock Production in Southwestern North Dakota

1. Develop usable strategies for 12 month forage management for livestock production based on several selected ratios of pasture and harvested annual and perennial forages.
2. Compare costs of production and operation of the forage management strategies.

Project: Postpartum Supplementation of Beef Cows in Thin or Moderate Body Condition Prior to Calving

1. Determine if prepartum body condition will interact with type of postpartum supplementation to effect beef cow performance, reproduction and calf growth measurements.
2. Compare postpartum beef cow performance, reproduction and calf growth responses when cows are fed either a protein or starch containing energy supplement after calving while maintained on an 8% CP forage diet fed ad libitum.
3. Provide beef cow postpartum supplementation guidelines based on body condition at calving.

Project: Financial and Production Analysis of Heifer Development

1. To validate current recommended heifer selection, development and management practices in western North Dakota.
2. To evaluate selection criteria on the beef replacement heifer and its effect of subsequent lifetime productivity.
3. To correlate the associated costs of heifer development on varying herd replacement levels.
4. To promote the use of performance records in replacement heifer selection and management.

Project: Beef Cattle Collaborative Study: Grazing Value and Management of CRP Lands

1. Determine the floristic composition and structure of CRP lands and to note changes in floristic composition and structure due to grazing and haying over five years.
2. Determine the production and utilization of CRP land vegetation under seasonlong and twice-over grazing.
3. Determine the production and quality of hay from CRP lands.
4. Determine the success of game and non-game wildlife species on CRP lands.
5. Determine the erosion from CRP lands that have been variously grazed and hayed and to compare this with similar cropland.
6. Determine the economic returns from grazing and haying CRP lands.

Kris Alan Ringwall

Current NDSU Administrative Responsibilities:

Dr. Ringwall is the Director of the Dickinson Research Extension Center and provides supervision for five full time faculty and ten full time classified staff, as well as a part-time staff of ten to twenty individuals depending on seasonal workloads. Today the Dickinson Research Extension Center operates on 4916 acres and integrates scientists from different backgrounds and disciplines to best serve the needs of southwestern North Dakota agriculture. The center is conducting system-oriented, value-added research projects requested by farmers and ranchers. Close working relationships are being fostered between NDSU Agricultural Experiment Station and Extension Service personnel. Two scientists have joint NDSU Agricultural Experiment Station and Extension Service appointments, and three scientists are involved in teaching and/or advising at Dickinson State University.

International, National and Regional Professional Development Activities:

Minnesota IRM Workshop
Manitoba IRM Workshop
Sheep Breeding Symposium
National Cattlemen's Midyear Conference
Technical Committee – Cow Calf Profitability Indicators
Great Plains Beef Cattle Resources Committee
Midwest Section American Society of Animal Science
Beef Improvement Federation
Old West Trail Country Livestock Symposium

Grant and Contract Experience:

Beef Cattle Improvement NDBCIA Inc. (\$16,003.31); Private beef producers (\$6,400.00); North Dakota Sheep School (\$588.50); Swine Development (ND APUC) (\$72,000.00); Heifer Development (NDBCIA) (\$25,000.00); National "Ewe-Ask" Sheep (ES-USDA) (\$40,000.00); Swine Production (North Dakota Pork Producers) (\$5,000.00); Swine Production (North Dakota Barley Council) (\$13,200.00).

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CHAPS III @ 1993

Over half of the state Extension Services within the United States and two provinces of Canada actively utilize the CHAPS program currently under the direction of Dr. Ringwall. CHAPS III (Cow Herd Appraisal Performance Software) is the first production and performance software to comply with NCA-IRM-SPA production guidelines in the country and the first software to be certified by the National Cattlemen's Association. SPA (Standardized Performance Analysis) is a standardized methodology for determining production and unit cost of production for the cow-calf enterprise.

Extension and Teaching Experience:

Beef Cattle Performance Testing – Project Leader

Over two hundred thousand cows are evaluated annually through the Beef Cow Herd Analysis Program (CHAPS) across the United States. CHAPS was developed by Dr. Ringwall and is supported as a central processing or microcomputer program that can process unlimited cow numbers along with all the individual calf records for a herd. The standardized production and financial performance analysis (SPA) is incorporated into CHAPS. The SPA analysis was developed through an effort of NCA producers, the National Integrated Resource Management Coordinating Committee, and Extension Specialists from six states.

Beef Cattle Integrated Resource Management (IRM) Program – Project Leader

Beef IRM is an integrated approach to increase profitability in beef production. Integrated Resource Management has been a buzz word in the beef industry for some time; however, understanding and implementation have been slow, probably due to the fact that IRM is widely misunderstood or defined differently by various people. What IRM really is, as defined by the National IRM Coordinating Committee, is: “An interdisciplinary approach to identify and implement farm and ranch management decisions that help producers/industry use their resources to attain their goals within the context of society’s concerns.” In North Dakota, IRM has been defined as a fact based program that can balance production and financial resources, with the bottom line to achieve producer driven goals. IRM utilizes a systematic approach to solve individual ranch concerns or problems identified by the producer through production and financial record analysis. IRM is the integration of production and financial records to solve a ranch’s problems. Extension’s role is to facilitate the process and implement the integrated approach. Currently, over 300 producers are learning how to spot problem areas in their operation through the use of software programs such as CHAPS (production evaluations) and FARMS (financial evaluations).

Extension Producer Talks and Direct Contacts:

Beef – 43 meetings and 6,359 producer contacts
Sheep – 5 meetings and 261 producer contacts

Current Committees and Councils Cooperated With and Role:

Animal and Range Science Sheep Committee	member
Beef Improvement Federation	member
Dickinson/Hettinger Research Extension Advisory Board	participant
Dickinson State University Ag Dept. Advisory Board	participant
National Cattleman’s Association	member
North Dakota Agricultural Products Utilization Comm.	cooperator
North Dakota Barley Council	cooperator
North Dakota Beef Cattle Improvement Association	advisor
North Dakota Cow/Calf Day committee	chairman
North Dakota Mohair Producers	advisor
North Dakota Lamb and Wool Producers	advisor
North Dakota Stockmen’s Association	member
North Dakota Stockmen’s Association-Purebred Board	advisor
North Dakota Veterinary Medical Association	advisor
Southwest Area Extension Advisory Board	cooperator
Task Force on Improving Profitability of Livestock	member

Papers, Proceedings, Reports, and Abstracts:

- K.A. Ringwall, P.M. Berg and S. Clark. 1994. CHAPS III – The cow herd appraisal performance system. *J. Anim. Sci.* (Abstract).
- P.M. Berg and K.A. Ringwall. 1994. NCA-IRM-SPA cow-calf enterprise summary of reproduction and production performance measures for North Dakota cow-calf producers. *J. Anim. Sci.* (Abstract).
- K.A. Ringwall, P.M. Berg, J.S. Caton and T.C. Faller. 1994. Mid-gestation and late gestation protein supplementation of Angora nannies and Rambouillet ewes fed low quality roughage diets. 35th Ann. Western Dakota Sheep Day. NDSU R&E Center, Hettinger, ND. February 9. p. 14-26.
- K.A. Ringwall, T.C. Faller, and P.M. Berg. 1994. Reproductive characteristics of mature and yearling Rambouillet ewes when exposed during April and July to produce September and January lambs. 35th Ann. Western Dakota Sheep Day. NDSU R&E Center, Hettinger, ND. February 9. p. 27-28.
- K.A. Ringwall, P.M. Berg, T.C. Faller, P.L. Marek and J.W. Galbreth. 1994. Understanding the components of sheep reproduction. 35th Ann. Western Dakota Sheep Day. NDSU R&E Center, Hettinger, ND. February 9. p. 29-52.
- K.A. Ringwall, P.M. Berg and D.L. Boggs. 1994. Utilizing performance and production records in commercial beef cattle operations I. Appraisal of cow herd productivity. NDSU Extension Service Bulletin (accepted).
- K.A. Ringwall, P.M. Berg and D. L. Boggs. 1994. Utilizing performance and production records in commercial beef cattle operations II. Utilization of CSF herd evaluations and individual performance data. NDSU Extension Service Bulletin (accepted).
- K.A. Ringwall. 1993. CHAPS – Progress through performance. *National Cattlemen's Integrated Resource Management News* 3-1:3.
- K.A. Ringwall. 1993. Using performance and production data in commercial cattle operations. *Beef Feed Facts* 3-3:2-5.
- K.A. Ringwall. 1993. Cow herd production data vital to productivity. *Beef Feed Facts* 3-2:4-5.
- K.A. Ringwall, P.M. Berg, T.C. Faller, P.L. Marek and J.W. Galbreth. 1993. Understanding the components of sheep reproduction. *Proceedings of a four state conference on Breeding Season Strategies for Improving Flock Output*. July 16-17, 1993, Sioux City, Iowa. p. 27-48.
- K.A. Ringwall and E.P. Arntson. 1993. Memorandum of understanding. Development and implementation of an agricultural education and research consortium in southwestern North Dakota between North Dakota State University and Dickinson State University. State Board of Higher Education, Bismarck, ND.
- K.A. Ringwall. 1993. Editor. *Proceedings of the 9th North Dakota Cow/Calf Conference*. North Dakota State University Extension Service, Fargo, ND.
- Carr, P.M., and K.A. Ringwall. 1993. Improving communication: a North Dakota research center's integration of extension, research, and teaching. *American Society of Agronomy Annual Meeting*, Cincinnati, OH, 1993.

Douglas Landblom

Swine Research:

Title – Nutritional Relationships for Sow Productivity and Lean Growth. Landblom, D.G., W.D. Slinger, E.W. Boland and K.A. Ringwall. This project received NDSU final approval in June 1994. Objectives: 1) To determine the effect of gestation energy level on sow body condition, lactation weight change, and litter and rebreeding performance; 2) To determine the effect of modifying lysine to energy ratios during lactation on sow body condition, lactation weight change, and litter and rebreeding performance; 3) To determine the effect of lysine/energy ratio modifications on performance and carcass merit of growing-finishing pigs. Herd repopulation has been completed using Pig Improvement Company's Camborough – 15 female line, and to maximize heterosis and leanness PIC's 326-II boar line is being used for terminal crossing. To date the new gilts have been quarantined, acclimatized and the first breeding group in cycle one has been bred. A rolling herd size of 65 to 70 females will be maintained to fulfill the objectives of this nutritional relationship project.

Swine Education:

Through funding provided by the North Dakota Agricultural Product Utilization Commission, a grant was received to conduct swine education classes and to provide on farm consultant services for students enrolled in the program. Informational meetings were held in Dickinson and Hettinger in early March, and classes began in late March. Classes are meeting regularly in Dickinson and Hettinger and will continue until December 1994. Class instruction has focused heavily on swine production management and total farm record keeping management. A request for extension of this educational opportunity for producers has been applied for and is pending.

Grants:

North Dakota Agricultural Product Utilization Commission. Participated with Dr. Kris Ringwall in acquisition of the grant (\$72,000.00) and serve as project coordinator.

Nutritional Relationships for Sow Productivity and Lean Growth: (\$5,000.00) from the ND Pork Producers Council; (\$13,200.00) from the North Dakota Barley Council.

Presentations, Seminars, Workshops, Interviews, Reports and Visitations:

Presented – Research grant request to the ND Barley Council

Presented – Research update to DREC Advisory Board

Attended – Regularly scheduled SW Shippers Assoc. Meetings

Chaired – Several SW Shippers Assoc. Proposed Buying Cooperative Subcommittee Meetings

Workshop – Conducted Swine AI workshop in conjunction with the SW Region Pork Producers Annual Meeting

Attended – ND Pork Producers Annual Meeting and Seminar

Attended – Livestock Water Quality Seminar
Seminar – Conducted the Dakota Swine Development Seminar, Bismarck Ramada Hotel
Interview – Participated with Mr. Dale Miller, Editor, National Hog Farmer Magazine in interviews with SW Shippers Assoc. members and trucking contractor, Dale Donner
Interview – Conducted personal interview with Mr. Dale Miller, NHF Magazine. RE: Swine Rearing Systems article
Presented – Swine Development Project informational meetings in Dickinson and Hettinger
Presented – Swine Development Classes during March, April, May and June in Dickinson and Hettinger
Visits – Conducted on farm Swine Development Project visitations
Attended – ND Pork Producers State Board Budget Planning Meeting and presented grant request
Attended – DREC Crops Field Day
Chaired – First meeting of the newly formed DREC Swine Advisory Council

Outreach:

American Society of Animal Science
Dickinson Chamber of Commerce Agricultural Committee
Gideons International
Chair, Dickinson Youth for Christ Executive Board

Llewellyn L. Manske

Research projects:

Defoliation Effects on the Structure and Dynamics of Grassland Ecosystems

The objectives of this project are: Determine the impacts that defoliation of grass plants by grazing, mowing and fire has on soil nutrients (Nitrogen, Carbon, Phosphorus) and availability for plant growth, and the effects on the soil microorganisms and their function as a symbiotic component of the rhizosphere of the grassland ecosystems; Determine the effects that defoliation has on stimulation of activation of axillary buds and their development into tillers; Determine optimum season for use as domesticated grass pastures and native range based on plant phenology, nutrient cycling, soil organisms, and livestock requirements.

Grazing Management to Affect Grasshopper Populations

The objectives of this project are: Determine if livestock grazing management can be used to effectively change the vegetation canopy to a level that has negative effects on the grasshopper population dynamics of the economically important grasshopper species.

Integrated Annual-Perennial Forage Systems for Livestock Production in Southwestern North Dakota

The objectives of this project are: Develop usable strategies for 12 month forage management for livestock production based on several selected ratios of pasture and harvested annual and perennial forages; Compare costs of production and operation of the forage management strategies;

Grants: Grazing management to affect grasshopper populations USDA/APHIS (\$20,009)

Papers, Proceedings, Reports, and Abstracts:

- Manske, L.L. 1993. Putting Up Hay In The Rain. SW District Extension Service, NDSU. release 3pp.
- Manske, L.L. 1993. Grazing Management To Affect Grasshopper Populations. Grasshopper Integrated Pest Management Project Field Day. Watford City, ND. Abstract.
- Manske, L.L. 1993. Results of Grazing Oat/Pea Annual Crop. The Fence Post. Donald Nordby Ed. NDSU Extension Service.
- Manske, L.L. (in review). Grazing Management Timed With Grass Phenological Development To Effect Beneficial Changes in Grassland Plant Communities. USDA/APHIS Grasshopper Integrated Pest Management Project. 12 pp.
- Manske, L.L. 1993. Grazing Management May Affect Egg Laying by Rangeland Hoppers. GHIPM Hoppenings, USDA/APHIS, Boise, Idaho. October issue.
- Manske, L.L. 1993. Grazing Annual Forage Pastures in Western North Dakota. SW District Extension Service. NDSU release. 2pp. October.
- Manske, L.L. 1993. Grazing Annual Forages in Summer Pasture Alternative. NDSU Extension Service News Release. Gary Moran, Ag. Editor. November.
- Project leaders (Onsager, J. (ARS) and L. Manske (NDSU). 1993. Rangeland Grazing Management Technology Transfer, Product Plan 15. P. 23. IN GHIPM Technical Work Group, Knight, S. (Staff Ed.). Grasshopper Integrated Pest Management Project Technology Transfer Plan. USDA/APHIS. Boise, Idaho. 27p.
- Belovsky, G.E. and L.L. Manske. (in review). Grasshopper Habitat Manipulation. USDA/APHIS Grasshopper Integrated Pest Management Project. 8pp.
- Manske, L.L. 1994. Grazing Management Used to Manipulate Adaptive Tolerance Mechanisms in Grassland Plants to Effect Beneficial Changes in Grassland Ecosystems. Summary Research Report. Dickinson Research Extension Center, NDSU, Dickinson, ND. 13p.
- Manske, L.L. 1994. Modification of Vegetation by Grazing and Mowing Management to affect Grasshopper Populations. Cooperative Grasshopper Integrated Pest Management Project, 1993 Annual Report. USDA/APHIS. Boise, Idaho. p. 81-89.
- Manske, L.L. (in review) Beneficial Changes of Rangeland Through Proper Grazing. Grasshopper Integrated Pest Management Handbook. Chapter. In USDA/APHIS GHIPM Project. 11 p.
- Manske, L.L. (in review) History and Land Use Practices in the Little Missouri Badlands and Western North Dakota. USDI Bull. National Park Service. 18 p.

Presentations, oral papers, workshops, seminars, and reports:

Presentation. Perennial forages, alfalfa, crested wheatgrass, and bromegrass, Dickinson Research Center Field Day. Dickinson, ND 7 July 1993 0.33 Hr. 65 people; Presentation. Preliminary data on grazing management effects on grasshopper habitat. Grasshopper Integrated Pest Management Project Field Day. Watford, City, ND 21 July 1993 0.33 Hr. 80 people; Banquet Speaker. Ecology of grazing on grass plants and effects on grasshopper habitat. Grasshopper Integrated Pest Management Project Field Day. Arnegard, ND 21 July 1993 1.25 Hr. 50 people; Presentation. Timing of grazing to affect grass tillering and herbage growth. Manitoba Agriculture. Vita, Manitoba. 16 August 1993 1.0 Hr. 8 people; Presentation. Principles of vegetative reproduction in prairie plants and how it relates to prairie restoration. Meeting with Manitoba Department of Natural Resources, Prairie Habitats Program, Manitoba Habitat Heritage, Wildlife Habitat Canada, and Critical Wildlife Habitat. Winnipeg, Manitoba. 18 August 1993 2.5 Hrs 14 people; Presentation. Grass plant buds and soil organism manipulation by grazing. Bowman/Slope County Riding Range Tour. Amidon, ND. 9 September 1993 1.5 Hrs. 25 people & Informal 1.25 Hrs. 9 people; Lecture. How grasses grow. Dickinson State University. Range Management Class. 15 September 1993 50 Min 10 people; Lecture. Evolutionary adaptive mechanisms for grasses to coexist with grazing. Dickinson State University. Range Management Class. 17 September 1993 50 Min. 12 people; Seminar. Manipulation of grass growth to increase nutrition and forage by timing of grazing. Shields, ND. 29 September 1993 2.5 Hrs. 106 people; Seminar. Manipulation of grass growth to increase nutrition and forage by timing of grazing. Almont, ND 30 September 1993 1.5 Hrs. 54 people; Presentation. Ecology of Defoliation and Principles of Grazing Management. Bowman County Producers Grazing Meeting. Dickinson, ND 12 October 1993 2.0 Hrs. 14 people; In-Service Presentation. IRM Range Review of Resources on Livestock Operations, the information needed and the processes involved to help producers with grazing management. NDSU Extension Service Conference. Fargo, ND 21 October 1993 1.0 Hrs. 22 people; Presentation. Grazing Annual Forage Pastures in Western North Dakota. Medora Beef Day, Medora, ND 12 January 1994 1.5 Hr. 60 people; Presentation. Potential Use of Annual Forages as Pasture, Hay and Silage in Western North Dakota. Quad County Forage Clinic, New England, ND 19 January 1994 1.0 Hr. 17 people; Workshop. Native Rangeland Management for Utilizing Pastures More Effectively. Manitoba Agriculture Southwest Cattlemen Seminar, Melita, Manitoba, Canada 21 January 1994 1.5 Hr. 75 people; Workshop. Complementary Rotation Grazing Management. Rhame Beef Day, First Annual, Rhame, ND 27 January 1994 3.0 Hr. 70+ people; Reports. Rotation Grazing Management. Dickinson Research Center Roundup, Dickinson, ND 22 February 1994 2-0.5 Hr. Talks 12 People; Paper. Grazing Management to Effect Beneficial Changes in Grasslands. Grasshopper Integrated Pest Management Program, Boise, ID 2 March 1994 1.0 Hr. 60 people; Workshop. Grazing Management to Increase Herbage and Grass Density. Manitoba Agriculture. PFRA Community Pasture Managers Workshop, Brandon, Manitoba, Canada 10 March 1994 3.5 Hr. 32 people; Paper. History and Land use Practices in the Little Missouri Badlands. Leafy Spurge Strategic Planning Workshop, Dickinson, ND 30 March 1994 0.33 Hr. 70+ people; Workshop. Defoliation Management and Effects on Grassland Vegetation. Manitoba Habitat Heritage, Grassland Management Workshop, Virden, Manitoba, Canada 16 June 1994 3.5 Hr. 17 people; Workshop. Complementary Twice Over Rotation Grazing Management to Meet Vegetation Requirements and Livestock Nutritional Requirements. Soil Conservation Service Area III Range Training Workshop, Manning, ND 23 June 1994 2.0 Hr. 19 people.

Educational and Demonstration Range Field Tours:

Tours – 7 tours and 95 producer contacts, 30 hours

Media Communication:

TV interview 10 November 1993. Forage management for 12 month base for livestock production. Bismarck TV 7. Al Gustin; Newspaper interviews 21 January 1994. Summarized major points covered in workshop presentations for Manitoba Agricultural Cattlemen Seminar. Two reporters from two different local papers.

Land Management Recommendations:

Field or range inspections were made on 21 operations for individual producers and associations and grazing management plans issued or developed.

Meetings Attended:

Attended 33 meetings

Educational Improvement Meetings Attended:

Attended tall grass prairie tour and visited Turtle River State Park, Kelley Slough, Oakville Prairie, Prairie Chicken Wildlife Management Area, North Dakota, Lake Bronson State Park, Minnesota, and Tall Grass Prairie Preserve, Manitoba, and learned about the local history, geology, soils, vegetations, and ecology. The management history and practices were explained and discussed. 13-15 August 1993; Attended in-service workshop on growth and management of trees in urban and rural environments. NDSU Extension, Dickinson, ND 1 September 1993; NDSU Research Branch Station Conference Fargo, ND 18-21 October; NDSU Extension Service Conference Fargo, ND 19-22 October; Society for Range Management Scientific Paper Sessions Colorado Springs, CO 13-19 February.

Patrick Carr

Instruction:

Instruction responsibilities continued in the Agriculture Department at Dickinson State University during the 1993-94 calendar year. Courses taught included Agr. 120 Crop Production (4 sem. hrs. with laboratory), Agr. 225 Field Crops Management (3 sem. hrs.), Agr. 256 Soil Science (4 sem. hrs. with a laboratory), and Agr. 357 Soil Fertility and Fertilizers (3 sem. hrs.). Developed bound lecture-guide manual for students enrolled in Crop Production, beginning in 1994. Student advisory responsibilities were assigned (5 students), as was selection to the Curriculum Committee at Dickinson State University. Compensation to the research center for teaching at Dickinson State University was \$17,316.79.

Research/Scholarship Cash Grants/Gifts:

Corn Hybrid Testing (\$490.00); BASF Flax Herbicide Trial (\$500.00 cash + \$500.00 product); Co-Principle Investigator with J.C. Gardner and S.E. Edwardson, Strategic Alliance for Enhancing Production, Processing, and Marketing of Buckwheat in North Dakota (\$6000.00); Co-Investigator on Evaluation and Commercialization of Lupin in North Dakota project (\$1850.00 awarded to Dickinson Research Center).

Technical reviewer for Minnesota Agricultural Utilization Research Institute grant proposal PRO-127, 1993.

Honors and Awards:

Included in Marquis Who's Who in America, Who's Who in the Midwest, Who's Who in Science and Engineering, 1993-94 Editions

Papers, Proceedings, Reports, and Abstracts:

Carr, P.M., G.B. Martin, and B.A. Melchior. Mechanical and Chemical Weed Control in Flax. 1994. p. 211-216. *In* J.F. Carter (ed.) 55th Flax Institute of the United States, Fargo, ND, Jan. 27-28. 1994.

Carr, P., E. Eriksmoen, G. Martin, B. Melchior, and R. Olson. Tenth Annual Western Dakota Crops Day Annual Report. December 16, 1993. 77p.

Carr, P.M., B.G. Schatz, J.C. Gardner, S. Edwardson, and S.J. Guldan. 1993. Intercropping Wheat and Lentil in a Cool Semiarid Region. American Society of Agronomy Annual Meeting, Cincinnati, OH, 1993.

Carr, P.M., and K.A. Ringwall. 1993. Improving communication: a North Dakota research center's integration of extension, research, and teaching. American Society of Agronomy Annual Meeting, Cincinnati, OH, 1993.

Publications Peer-Reviewed:

Reviewer of manuscripts A-94-37 (*Agronomy Journal*); S-94-004 (*Soil Science Society of America Journal*)

Presentations:

Carr, P.M., Annual Forage Options, Dickinson Research Center Forage Day, February 22, 1994.

Carr, P.M., Crop Variety Options, Taylor Institute, Taylor, February 2, 1994.

Carr, P.M., G.B. Martin, and B.A. Melchior. Mechanical and Chemical Weed Control in Flax. 55th Flax Institute of the United States, Fargo, ND, Jan. 27-28. 1994.

Carr, P.M., Crop Research Update at the Dickinson Research Center, Golden Valley Grower Meeting, Beach, January 2, 1994.

Carr, P. Crop Variety Updates and Highlights of Ongoing Crop Production Research. Tenth Annual Western Dakota Crops Day. December 16, 1993.

Carr, P.M., B.G. Schatz, J.C. Gardner, S. Edwardson, and S.J. Guldan. 1993. Intercropping Wheat and Lentil in a Cool Semiarid Region. American Society of Agronomy Annual Meeting, Cincinnati, OH, 1993.

Carr, P.M., and K.A. Ringwall. 1993. Improving Communication: a North Dakota Research Center's Integration of Extension, Research, and Teaching. American Society of Agronomy Annual Meeting, Cincinnati, OH, 1993.

Carr, P.M. Carr, P.M. Crop Variety Updates, Beach, ND, July 22, 1993.

Carr, P.M. Carr, P.M. Crop Variety Updates, Glen Ullin, ND, July 13, 1993.

Carr, P.M. Carr, P.M. Crop Variety Updates, Hannover, ND, July 14, 1993.

Carr, P.M. Barley Variety Updates and Barley-Pea Intercrops. Presentation to the North Dakota Barley Council, Dickinson, July 8, 1993.

Carr, P.M. Crop Variety Updates and Cropping System Highlights of Ongoing Crop Production Research at the Dickinson Research Extension Center. Annual Summer Field Day, Dickinson, July 6, 1994.

Graduate Student Committees:

Graduate Committee Member of Phil Boeve, Ph.D. Candidate, Department of Entomology, NDSU (Mike Weiss, Graduate Advisor)

Professional Committees:

Member, NDSU Extension Service Program Planning Team #13 (Competitiveness and Profitability of Crop Production)

ND Representative, North Central Regional Committee 177, Nonherbicide Alternatives for Weed Management

Chair, HRM Task Force, ND Chapter, Soil and Water Conservation Society

Chair, Scholarship Committee, ND Chapter, Soil and Water Conservation Society

Professional Affiliations:

Agronomy Society of America
American Association for the Advancement of Science
Crop Science Society of America
Flax Institute of the United States
Soil and Water Conservation Society
Soil Science Society of America

Research Projects (Initiated in 1993):

Wheat Production Systems for Southwestern North Dakota.

First-year data in a *HRSW Cultivar x Seeding Rate x Tillage System Trial* revealed significant ($P < 0.05$) differences between HRSW cultivars for kernel weight, test weight, grain yield, and grain protein content. Both 'Bergen' and 'Norm' cultivars produced around 39 bu/ac across tillage systems and seeding rates; yield for 'Grandin', 'Amidon', and 'AC Minto' cultivars was 34, 33, and 31 bu/ac, respectively. Increasing the seeding rate from 500 000 to 1 500 000 PLS/ac generally increased grain yields for all cultivars, particularly in a no-tillage environment. An application of the fungicide Mancozeb at the Haun 8.0 growth stage for wheat failed to influence yield in a *HRSW Fungicide x N Rate x Tillage System Trial*. However, kernel weight was significantly increased by fungicide application in conventional-tillage, reduced-tillage, and no-tillage environments. A HRSW cultivar x Cropping System Trial was begun in 1993. Five conventional-height and five semidwarf HRSW cultivars are being compared in a *HRSW Cultivar x Cropping System Trial* across three 2-year cropping sequences (wheat-wheat, wheat-black fallow, wheat-corn). Cropping sequences were put into place in 1993; 1994 data will be reported.

Evaluation of Small Grain Cultivars in Southwestern North Dakota.

Grain yield across small grain cultivar trials was reduced compared to 1992 by disease. Average yield in the HRSW cultivar trial was 46 bu/ac. Average yield for the durum wheat cultivars was 48 bu/ac. Barley cultivars averaged 77 bu/ac at Dickinson in 1993, and oat cultivars averaged 143 bu/ac. Grain quality (kernel weight, test weight) was generally poor across small grain cultivar trials in 1993, with the exception of oat.

Alternative Crops and Cropping Systems for Southwestern North Dakota.

Spring triticale cultivars produced an average of 71 bu/ac in a *Triticale Trial*. Test weight of the cultivars in this trial ranged from 45 to 55 lbs. Several Lupin accessions in a *Lupin Nursery* failed to reach physiological maturity at Dickinson because of the unusually cool growing conditions and early fall frost. Still, yield of 9 of the 17 accessions included in the nursery averaged 1655 lbs/ac.. Growing barley or oat along with pea failed to significantly influence forage yield compared to growing either small grain crop alone in a *Cereal-Pea Intercrop Trial*. Forage yield averaged 4.86 tons/ac (12% moisture basis) in a fallowed environment across treatments, and 3.21 tons/ac in a recropped environment. Cereal-pea forage was superior to cereal forage in regards to total digestible nutrients, but only by 1-2 percentage points in the samples that were compared. There was no dry matter yield or quality advantage of a forage-type barley or oat cultivar compared to a conventional-type cultivar when intercropped with field pea, or when sole cropped.

James Nelson

Weather in 1993 was wetter and cooler than normal. Total precipitation was 16.98". This was 1.1" more than the 100 year average. April through July precipitation was 13.14" which compares to a long time average of 9.43". There were 116 frost free days between May 20 and September 13, 1993. The station recorded a low of -34 degrees Fahrenheit on February 24 and a high of 91 degrees Fahrenheit on July 21. Cereal crops made excellent yields while corn was slow to develop due to the cool weather.

The station saw a high level of oil field activity following the successful drilling of a Conoco well on Sec. 32, 140-96, almost in the middle of our cattle winter feeding area. This well is reported to be one of the best producers in North Dakota. The station was surveyed and dug up for the installation of a new water pipe line that is part of the Southwest Water Development. The station expects to receive pipe line water by late October, 1994.

Under the leadership of Dr. Ringwall, the station joined a consortium made up of the Dickinson Research Center, Dickinson State University and the NDSU Area Extension Center. Several staff members are involved with teaching assignments in both agronomy and animal science. Dr. Carr taught several soil and agronomy courses while Jim Nelson and Dr. Ringwall taught Animal Science 140 and Animal Science 248. These two (three semester credit) classes were taught to a total of 54 students. The DSU Ag Department Advisory Board helped select Dr. Gary White as Department Chairman following the retirement of Eric Arntson.

Remodeling the 1905 vintage seed house at the station was completed. This building provides office space for five professional staff, a home for the CHAPS program as well as bathrooms, reception, conference and kitchen facilities. An open house was held in conjunction with Arbor Day on May 14, 1994.

In January 1993, the DRC disbursed the registered Polled Hereford cow herd. The station is concentrating on crossbred Angus x Hereford cow herd using both station raised as well as purchased bred heifers. Fifty head of heifers purchased from the Walton Bean Company were calved along with 50 head of station heifers. A heifer development and calving school was held at DSU in February and was well attended by producers from across North Dakota and Montana. The milking-shorthorn crossbred cows were sold in the Fall of 1993. As of July 1, 1994, the inventory of livestock included 286 cows, 284 calves, 86 bred yearling heifers, 21 bulls, six saddle horses, 36 ewes and a group of breeding age PIC gilts and boars. The station is also pasturing ninety head of bred crossbred heifers that are part of a complete heifer development project.

Carry over feed included approximately 370 ton of hay, 300 ton of straw, and 700 ton of bagged oatlage. Feed production for the station was enhanced on several areas. Approximately 180 acres of Ladak Alfalfa was seeded using a Tye no-till drill. Stand establishment in 1993 was excellent. This alfalfa acreage replaced acreage of old, low producing Crested Wheatgrass. Forage production at the ranch headquarters included oats and peas, oats, and forage barley. These crops were harvested and stored in large plastic bags, using a rented Ag Bag machine. Quality of feed stored this way was excellent. Following the harvest of the oatlage, winter rye was seeded using a Tye no-till drill. Lack of late summer and fall precipitation limited rye production but we did graze the fields in the fall. These fields were located on Section 24 at ranch headquarters which was surveyed and fenced with four strands of barbed wire and steel posts in fall of 1993.

The station also contracted to harvest approximately 36 miles of Interstate 94 right-away. This produced approximately 300 ton of cow feed.

A pilot planting of corn using no-till planting and chemical weed control was carried out on Section 24. Fifty-four acres were custom seeded by Robert Ferbee on May 10, 1993, using an International no-till corn planter. Soil fertility was enhanced by adding approximately 200 pounds per acre of Ammonium Sulfate fertilizer along with 100 pounds of 31-24-0 applied at planting. The Ammonium Sulfate fertilizer was donated by the American Natural Gas plant north of Beulah, North Dakota. Weeds were controlled using a combination of FallowMaster pre-emergence, and Accent or Frontier applied post-emergence when the corn was 18-20" tall. Silage yields were 10 ton per acre with 40% DM and 8.75% protein. Cost per ton of silage was \$10.78/ton. Approximately 80 acres of crop land was fenced and provided with water in order to conduct a forage study using annual crops as a source of pasture for beef cows. There are eight pastures averaging eight acres/pasture. Crops seeded included oats and peas, Siberian Millet, Pearl Millet, and Rye. A high population of weeds, especially cocklebur caused lower yields. The electric cross fencing between pastures and treatments was not adequate to control the animals.

Work was started on a shelterbelt renovation study in cooperation with the Area Soil Conservation Service.

The NDSU Horticultural Department continued a tree hardiness study under the leadership of Lawrence Chaput. Dr. Ron Smith and Jerry Larson started a new study in the area of low maintenance lawn grass seeding and care for western North Dakota. Also included in this area are garden plots, flowers and tree care. Turfgrass species and cultivars were planted on 6/15/94, to augment the plantings that were successfully carried out during the summer of 1993. Eight species and cultivars were planted to evaluate for their winter hardiness, drought/heat resistance, pest tolerance and general desirable turfgrass characteristics. Ideal conditions existed for this planting effort, nearly identical to the conditions experienced in 1993: rainy weather preceding the planting, cool, cloudy weather during the planting, and a gentle rain following the planting. Each plot size is 10' x 8' in size, replicated three times. They are located directly south of the plots established the previous year. Many of the grasses are the "second generation" of successful species that were trialed years ago at the Carrington Research and Extension Center. A small planting of herbaceous flowers, herbs, and ornamental grasses were planted just north of these grass plots.

A small demonstration of vegetables were also planted earlier in the spring. As of 6/15, most of the seedling emergence was completed, with the first true leaves developing. With the current rains and hopefully subsequent warm summer weather, the garden should make a good showing by mid-summer. All transplants were watered in with Miracle-Grow.

Wildflowers for dry summers – 8 oz. of seed – were planted over a 2400 square foot area just south of the vegetable plantings. No color of significance is expected this growing season, but if history repeats itself from other areas of the state, repeat shows of beautiful flowers should be enjoyed for years to come. After the initial year, these plantings require just an annual mowing to maintain the diversity and beauty.

The second year of a proposed five year Conservation Reserve Program Grazing and Haying Study was completed. In 1993, fifty-two cow calf pairs grazed the CRP site at Tom Lambourn's ranch south of Bowman. The cattle grazed either in a season long pasture (17 hd) or a twice-over rotation system (35 hd). Cow gain during the 126 grazing period averaged 0.87 lbs/hd/day. Calves gained 2.63 lbs/day on the twice over system vs, 2.52 on the season long pastures. The trial to date is summarized in a booklet entitled Conservation Reserve Program (CRP) Grazing and Haying Study 1992-93 by Dr. William Barker, et al.