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Agricultural Research Division 100th Annual Report, July 1, 1985, to June 30, 1986

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100th Annual Report

**University of Nebraska
Agricultural Research Division**

July 1, 1985 to June 30, 1986

**Agricultural Research Division
University of Nebraska
Institute of Agriculture and Natural Resources
Irvin T. Omtvedt, Dean and Director**



The Nebraska Agricultural Research Division provides information and educational programs to all people without regard to race, color, national origin, sex or handicap.





100th

Annual Report

**University of Nebraska
Agricultural Research Division**

July 1, 1985 to June 30, 1986

**Agricultural Research Division
University of Nebraska
Institute of Agriculture and Natural Resources
Irvin T. Omtvedt, Dean and Director**



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FOREWORD

This 100th Annual Report contains lists of current faculty, active projects, refereed journal publications, brief descriptions of research in selected areas, and the financial report for the period July 1, 1985 through June 30, 1986. Research programs in agriculture, home economics, and natural resources at the University of Nebraska have changed greatly since the U. S. Congress approved the establishment of an Agricultural Experiment Station in each state with the passage of the Hatch Act on March 2, 1887. Although Hatch funds account for a smaller proportion of the total research expenditures in the program today, this legislation continues to be an important source of funding for addressing priority problems that require long-term research projects.

Faculty conducting research in agriculture, home economics, and natural resources in the University of Nebraska Institute of Agriculture and Natural Resources carry research appointments in the Agricultural Research Division. Most faculty are on joint appointments with teaching responsibilities in the College of Agriculture or the College of Home Economics or serve as extension specialists with appointments in the Cooperative Extension Service. As of June 30, 1986, the 136 full-time equivalents in the Agricultural Research Division were distributed among 260 faculty.

The Agricultural Research Division faculty are located on the East Campus of the University of Nebraska in Lincoln and at the District Research and Extension Centers at Clay Center, Concord, North Platte, and Scottsbluff. The University of Nebraska Agricultural Research and Development Center near Mead serves as the primary site for projects involving livestock or field plots for faculty located on the East Campus.

The primary program goals for the Agricultural Research Division are:

- To address priority problems facing Nebraska's agricultural and food industries;
- To provide an expanded knowledge base for future developments in production, processing and distribution of agricultural products; and
- To provide research results to advance quality of life opportunities for all Nebraskans.

Results derived from various projects are published in scientific journals, trade journals, bulletins, University publications, and in departmental reports. The research results then become the information base for educational programs and publications prepared by the Nebraska Cooperative Extension Service. Reprints of most journal articles may be obtained by writing directly to the authors.

Researchers in the Agricultural Research Division are part of a national network of agricultural experiment station scientists located at land-grant universities across the United States. Nebraska researchers are currently involved in over 60 regional projects where they cooperate with scientists at other universities in addressing priority problems of regional importance. High priority is given to working cooperatively with USDA and US Forest Service researchers with similar responsibilities. There are currently 32 federally supported scientists located on East Campus and 33 scientists at the Roman L. Hruska U. S. Meat Animal Research Center at Clay Center who work jointly with IANR researchers. Several faculty in the Agricultural Research Division are also involved in cooperative projects with University of Nebraska faculty at the Medical Center and on City Campus.

For additional information regarding the Agricultural Research Division program, contact the Office of the Dean and Director, 109 Agricultural Hall, University of Nebraska, Lincoln, Nebraska 68583-0704.



Irvin T. Omtvedt
Dean for Agricultural Research and
Director of the Nebraska Agricultural Experiment Station
University of Nebraska - Lincoln

University of Nebraska

Board of Regents

Donald C. Fricke, Lincoln

James H. Moylan, Omaha

Kermit Hansen, Elkhorn

John W. Payne, Kearney

Nancy Hoch, Nebraska City

Margaret Robinson, Norfolk

Robert R. Koefoot, Grand Island

Robert G. Simmons, Jr., Scottsbluff

Greg Paul, UNMC

Allison Brown Corson, UNO

Chris Scudder, UNL

Administrative Officers

Ronald W. Roskens, President, University of Nebraska

Martin A. Massengale, Chancellor, University of Nebraska - Lincoln

Roy G. Arnold, Vice Chancellor, Institute of Agriculture and Natural Resources

Agricultural Research Division

Irvin T. Omtvedt, Dean and Director

Dale H. Vanderholm, Associate Dean and Associate Director

William L. Powers, Assistant Director for Water Research

Warren W. Sahs, Assistant Director for Operations

Administrative Units Reporting To Deans And Directors

Institute of Agriculture and Natural Resources
The University of Nebraska - Lincoln

June 1986

Agricultural Academic Program Units (Extension, Research and Teaching)

AGRICULTURAL BIOCHEMISTRY
Herman W. Knoche
AGRICULTURAL COMMUNICATIONS
Jay P. Holman
AGRICULTURAL ECONOMICS
William L. Miller
AGRICULTURAL ENGINEERING
William E. Splinter
AGRONOMY
Darrell W. Nelson
ANIMAL SCIENCE
Elton D. Aberle
BIOMETRICS AND INFORMATION SYSTEMS CENTER
W. M. Schutz
CENTER FOR AGRICULTURAL METEOROLOGY AND CLIMATOLOGY
Norman J. Rosenberg
ENTOMOLOGY
Roger E. Gold
ENVIRONMENTAL PROGRAMS
Roger E. Gold
FOOD PROCESSING CENTER
Charles E. Walker
FOOD SCIENCE AND TECHNOLOGY
Charles E. Walker
FORESTRY, FISHERIES AND WILDLIFE
Gary L. Hergenrader
HORTICULTURE
Roger D. Uhlinger
PLANT PATHOLOGY
Anne K. Vidaver
VETERINARY SCIENCE
John A. Schmitz

Home Economics Departments (Extension and Research)

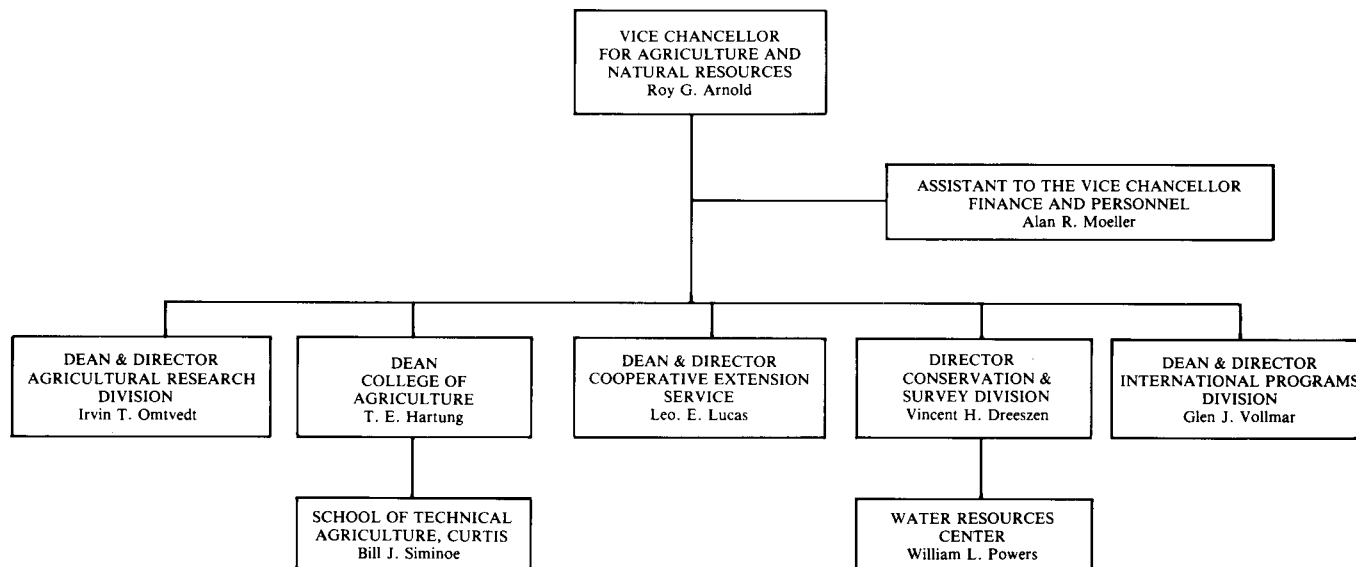
CONSUMER SCIENCE AND EDUCATION
Gwendolyn Newkirk
HUMAN DEVELOPMENT AND THE FAMILY
Helen C. Sulek
HUMAN NUTRITION AND FOOD SERVICE
MANAGEMENT
Hazel M. Fox
TEXTILES, CLOTHING AND DESIGN
Joan M. Laughlin

Off-Campus Centers (Extension and Research)

NORTHEAST RESEARCH AND EXTENSION CENTER,
Concord
Donald B. Hudman
WEST CENTRAL RESEARCH AND EXTENSION CENTER,
North Platte
Lavon J. Sumption
PANHANDLE RESEARCH AND EXTENSION CENTER,
Scottsbluff
Robert D. Fritschen
SOUTH CENTRAL RESEARCH AND EXTENSION CENTER,
Clay Center
Charles L. Stonecipher
SOUTHEAST RESEARCH AND EXTENSION CENTER,
Lincoln
Lloyd L. Young
AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER,
Mead
Warren W. Sahs

Organizational Chart

Institute of Agriculture and Natural Resources The University of Nebraska-Lincoln



Faculty



100th

Annual Report

University of Nebraska
Agricultural Research Division

Agricultural Research Division Faculty

	Rank	Rsch	Ext	Tch	Other	Area of Responsibility
Agricultural Biochemistry						
Herman W. Knoche	Professor	0.80		0.20		Head, Lipid Biochemistry
Raymond Chollet	Professor	0.88		0.12		Photosynthesis
J. M. Daly ¹	Professor	0.79		0.21		Plant Disease Biochemistry
Richard Dam	Associate Professor	0.84		0.16		Nutritional Biochemistry
Robert M. Hill	Associate Professor	0.80		0.20		Protein Biochemistry
Robert V. Klucas	Professor	0.90		0.10		Nitrogen Fixation
Ricky J. Krueger ²	Assistant Professor	0.80		0.20		Molecular Endocrinology
John P. Markwell	Assistant Professor	0.90		0.10		Plant Biochemistry
Robert L. Ogden	Assistant Professor	1.00				Alfalfa Processing
Robert J. Spreitzer	Assistant Professor	0.75		0.25		Plant Molecular Genetics
Fred W. Wagner	Professor	0.90		0.10		Enzymes
Agricultural Communications						
J. Phil Holman	Professor	0.19	0.53	0.19	0.09	Interim Head
Deloris R. Clouse	Professor	0.10	0.90			Educational Media
Richard L. Fleming	Professor	0.25	0.57	0.18		Marketing
James W. King	Associate Professor	0.20	0.70	0.10		Visual Aids
Kathleen L. Kline	Assistant Instructor	0.10	0.90			Publications
Daniel B. Lutz	Professor	0.10	0.80	0.10		News
Terrance Meisenbach	Assistant Instructor	0.22	0.78			Publications
Charlotte Murphy	Assistant Instructor	0.10	0.90			News
David E. Parrish	Assistant Instructor	0.20	0.60		0.20	News
James K. Randall	Professor	0.10	0.90			Radio
Edward F. Vitzthum	Assistant Professor	0.25	0.75			Environmental Programs
Agricultural Economics						
William L. Miller	Professor	0.40	0.30	0.30		Head
J. David Aiken	Associate Professor	0.55	0.35	0.10		Water Law
Dale G. Anderson	Professor	0.60		0.40		Marketing
Maurice E. Baker	Professor	0.60		0.40		Resource Economics
Allen L. Frederick	Professor	0.30	0.70			Public Policy Economics
Paul H. Gessaman	Professor	0.10	0.90			Agricultural Finance
James B. Hassler	Professor	0.60		0.40		Marketing and Price Analysis
Glenn A. Helmers	Professor	0.50		0.50		Farm Management and Production
Bruce B. Johnson	Associate Professor	0.47		0.53		Resource Economics
H. Douglas Jose	Associate Professor	0.20	0.80			Farm Management
James G. Kendrick	Professor	0.20		0.80		Marketing and Agricultural Policy
Dean A. Linsenmeyer	Associate Professor	0.60		0.40		Marketing
Lynn H. Lutgen	Associate Professor	0.30	0.70			Marketing
Emilio Pagoulatos	Professor	0.70		0.30		Marketing and International Trade

^{1/} Ended research appointment during 1985-86

^{2/} Began research appointment during 1985-86

(continued)

Faculty

	Rank	Rsch	Ext	Tch	Other	Area of Responsibility
<i>(Agricultural Economics....)</i>						
George H. Pfeiffer	Assistant Professor	0.40		0.60		Farm and Ranch Management
Raymond J. Supalla	Professor	0.75		0.25		Resource Economics
Michael S. Turner	Professor	0.10	0.50	0.15	0.25	Marketing
John F. Yanagida	Associate Professor	0.60		0.40		Quantitative Methods
Agricultural Education						
Osmund S. Gilbertson	Professor	0.20	0.15	0.65		Head
Allen G. Blezek	Associate Professor	0.25	0.25		0.50	LEAD
Roy B. Dillon	Professor	0.50		0.50		Curriculum Programs and Advanced Studies
James T. Horner	Professor	0.50	0.25	0.25		Advanced Studies
Agricultural Engineering						
William E. Splinter	Professor	0.50	0.30	0.20		Head, George Holmes Distinguished Professor
Leonard Bashford	Professor	0.50		0.50		Power and Machinery
Gerald R. Bodman	Associate Professor	0.25	0.75			Livestock Environment
Y. R. Chen	Associate Professor				USDA	Modeling Animal Physiology Processes
James A. DeShazer	Professor	0.75		0.25		Livestock Environment
Elbert C. Dickey	Associate Professor	0.25	0.75			Soil and Water Conservation
Conrad B. Gilbertson	Associate Professor				USDA	Livestock Waste Management
James R. Gilley	Professor	0.75		0.25		Irrigation Engineering
John E. Gilley	Assistant Professor				USDA	Soil and Water Conservation
Robert D. Grisso	Assistant Professor	0.25	0.75			Power and Machinery
G. L. Hahn	Professor				USDA	Animal Calorimetry
Milford A. Hanna	Professor	0.50		0.30	0.20	Food Engineering
A. G. Hashimoto	Professor				USDA	Modeling Animal Physiology Processes
Louis I. Leviticus	Professor	1.00				Tractor Testing
Derrel L. Martin	Assistant Professor	0.44		0.56		Irrigation Engineering
George E. Meyer	Associate Professor	0.75		0.25		Biological Engineering
Jack A. Nienaber	Associate Professor				USDA	Animal Calorimetry
Richard Pierce	Assistant Professor	0.20	0.80			Crop Processing
Dennis D. Schulte	Professor	0.67		0.33		Structures, Processing
LaVerne Stetson	Professor				USDA	Electrical Safety
Thomas L. Thompson	Professor	0.70		0.30		Product Processing and System
Kenneth Von Bargen	Professor	0.40		0.60		Systems Engineering
Howard D. Wittmuss	Associate Professor	0.53		0.47		Soil and Water Conservation
Agronomy						
Darrell W. Nelson	Professor	0.40	0.30	0.30		Head
Bruce E. Anderson	Assistant Professor	0.40	0.60			Forage Management
David J. Andrews	Professor	0.25			0.75	Millet and Sorghum Breeding
Roger J. Assmus	Assistant Instructor	0.23		0.77		Soil Chemistry/Fertility
P. Stephen Baenziger	Associate Professor	0.75				Small Grains Breeding and Genetics
Ralph B. Clark	Professor				USDA	Sorghum Physiology
Max Clegg	Associate Professor	0.85		0.15		Crop Physiology
William A. Compton	Professor	0.80		0.20		Corn Breeding

	Rank	Rsch	Ext	Tch	Other	Area of Responsibility
<i>(Agronomy....)</i>						
John W. Doran	Associate Professor				USDA	Soil Biochemistry
August F. Dreier	Professor	0.74	0.26			Crop Variety Evaluation
Jerry D. Eastin	Professor	0.85		0.15		Crop Physiology
James R. Ellis	Associate Professor				USDA	Soil Microbiology
Charles A. Francis ^{2/}	Professor	0.25	0.75			Crop Production
Byron C. Gabrielsen	Assistant Professor				USDA	Forage Physiology
Charles O. Gardner	Professor	0.70		0.30		Statistics, Genetics
Herman J. Gorz	Professor				USDA	Forage Genetics
Francis A. Haskins	Professor	0.80		0.20		Forage Genetics
Michael D. Jawson	Assistant Professor	0.65		0.35		Soil Microbiology
Virgil A. Johnson ¹	Professor				USDA	Wheat Breeding
Alice J. Jones	Assistant Professor	0.50	0.50			Soil Conservation
Lowell Klepper	Associate Professor	1.00				Crop Physiology
Delno Knudsen	Professor	0.50	0.50			Soil Testing
Steven L. Kuhr ¹	Assistant Professor				USDA	Wheat Genetics
David T. Lewis	Professor	0.40		0.60		Soil Genesis and Classification
Jerry Maranville	Professor	0.83		0.17		Sorghum Physiology
Alexander Martin	Professor	0.33	0.67			Weed Science
Stephen C. Mason	Assistant Professor	0.25		0.75		Crop Production
Robert A. Masters ²	Assistant Professor				USDA	Range Weed Control
Paul J. Mattern	Professor	1.00				Cereal Quality
Dennis McCallister	Assistant Professor	0.30		0.70		Soil Chemistry
Lloyd N. Mielke	Associate Professor				USDA	Soil Physics
Richard Mills	Professor	1.00				Foundation Seed Production
M. Rosalind Morris	Professor	0.64		0.36		Cytogenetics
Lowell E. Moser	Professor	0.18		0.82		Forage Physiology, Teaching Coordinator
John Norman	Professor	0.80		0.20		Water Resources and Crop Modeling
Robert Olson ¹	Professor	0.50		0.50		Soil Fertility
Edwin J. Penas	Associate Professor	0.25	0.75			Soil Fertility
C. James Peterson	Assistant Professor				USDA	Wheat Genetics
James F. Power	Professor				USDA	Soil Fertility
Donald H. Sander	Professor	0.50	0.50			Soil Fertility, Extension Coordinator
James S. Schepers	Associate Professor				USDA	Soil Chemistry
John W. Schmidt ¹	Professor	1.00				Small Grain Breeding
Patrick J. Shea	Assistant Professor	0.70		0.30		Herbicide Dissipation
Joseph H. Skopp	Assistant Professor	0.48		0.52		Soil Physics
Robert C. Sorensen	Professor	0.25		0.75		Soil Fertility
James E. Specht	Professor	0.80		0.20		Soybean Physiology and Breeding
Paul E. Staswick	Assistant Professor	0.75		0.25		Molecular Genetics
James Stubbendieck	Professor	0.50		0.50		Range Ecology and Manage- ment
Charles Y. Sullivan	Professor				USDA	Crop Physiology
Dale Swartzendruber	Professor	0.70		0.30		Soil Physics
Beth A. Swisher	Assistant Professor	0.50		0.50		Weed Physiology
Gary E. Varvel	Associate Professor				USDA	Soil Management
Kenneth P. Vogel	Associate Professor				USDA	Grass Breeding

(continued)

Faculty

	Rank	Rsch	Ext	Tch	Other	Area of Responsibility
<i>(Agronomy....)</i>						
Steven S. Waller	Professor	0.50		0.50		Range Management and Improvement
Daniel T. Walters	Assistant Professor	0.35		0.65		Soil Management
Wallace W. Wilhelm	Associate Professor				USDA	Crop Physiology
James H. Williams, Jr. ¹	Professor	0.75		0.25		Soybean Breeding
Animal Science						
Elton D. Aberle	Professor	0.35	0.34	0.31		Head
William T. Ahlschwede	Associate Professor	0.30	0.70			Swine Production
Mary M. Beck	Assistant Professor	0.60		0.40		Poultry Physiology
Gary L. Bennett	Assistant Professor				USDA	Breeding
Dennis R. Brink	Associate Professor	0.26		0.74		Ruminant Nutrition
Robert Britton	Professor	0.60		0.40		Ruminant Biochemistry
Chris R. Calkins	Assistant Professor	0.70		0.30		Meats
Ronald K. Christenson	Associate Professor				USDA	Physiology
Larry V. Cundiff	Professor				USDA	Breeding
Gordon E. Dickerson	Professor				USDA	Animal Breeding and Genetics
Franklin E. Eldridge	Professor	0.75		0.25		Dairy Breeding
Calvin L. Ferrell	Assistant Professor				USDA	Nutrition
Johny J. Ford	Associate Professor				USDA	Physiology
Earl W. Gleaves	Professor	0.25	0.75			Poultry Production
Keith E. Gregory	Professor				USDA	Breeding
Paul Q. Guyer	Professor	0.05	0.75	0.20		Beef Nutrition
Thomas G. Jenkins	Assistant Professor				USDA	Breeding
Rodger K. Johnson	Professor	0.50		0.50		Swine Breeding
Steven J. Jones	Assistant Professor	0.50		0.50		Meats
Jeffrey T. Keown	Associate Professor	0.30	0.70			Dairy Management
James E. Kinder	Associate Professor	0.50		0.50		Beef Physiology
Roger J. Kittok	Associate Professor	0.75		0.25		Reproductive Physiology
Terry J. Klopfenstein	Professor	0.56		0.44		Ruminant Nutrition
Robert M. Koch	Professor	1.00				Research Geneticist
Larry L. Larson	Associate Professor	0.50		0.50		Dairy Physiology
Austin J. Lewis	Professor	0.70		0.30		Swine Nutrition
Kreg A. Leymaster	Assistant Professor				USDA	Breeding
Roger Mandigo	Professor	0.50		0.50		Meats
Merlyn K. Nielsen	Professor	0.50		0.50		Beef Breeding
Robert R. Oltjen	Professor				USDA	Nutrition
Foster G. Owen	Professor	0.40	0.39	0.21		Dairy Nutrition
Ernest R. Peo, Jr.	Professor	0.50		0.50		Swine Nutrition
Wilson G. Pond	Professor				USDA	Nutrition
Bruce D. Schanbacher	Associate Professor				USDA	Physiology
Steven C. Seideman	Assistant Professor				USDA	Meats
Rick A. Stock	Assistant Professor	0.30	0.70			Feedlot Nutrition
Thomas W. Sullivan	Professor	0.60		0.40		Poultry Nutrition
John K. Ward	Professor	0.48		0.52		Beef Nutrition
Thomas H. Wise	Assistant Professor				USDA	Physiology
Jong-Tseng Yen	Associate Professor				USDA	Nutrition
Lawrence D. Young	Assistant Professor				USDA	Breeding
Dwane R. Zimmerman	Professor	0.50		0.50		Swine Physiology

	Rank	Rsch	Ext	Tch	Other	Area of Responsibility
Biometrics and Information Systems Center						
Wilfred M. Schutz	Professor	0.10	0.10	0.10	0.70	Head
James G. Emal	Associate Professor	0.25	0.75			Microcomputer Specialist
Stephen Lowry	Associate Professor	0.35		0.65		Statistical Consultant
Robert F. Mumm	Professor	0.67		0.33		Statistical Consultant
Anne Parkhurst	Associate Professor	0.70		0.30		Statistical Consultant
Ronald L. Roeber	Assistant Professor	0.25	0.75			Microcomputer Specialist
Walter W. Stroup	Associate Professor	0.35		0.65		Statistical Consultant
Center for Agricultural Meteorology and Climatology						
Norman Rosenberg	Professor	0.90		0.10		Director
Blaine Blad	Professor	0.78		0.22		Agricultural Meteorology
Kenneth Hubbard	Assistant Professor	0.25	0.25		0.50	Ag. Climatology & Conservation and Survey
Shashi Verma	Professor	0.77		0.23		Agricultural Meteorology
Albert Weiss ²	Associate Professor	1.00				Agricultural Meteorology
Consumer Science and Education						
Gwendolyn Newkirk	Professor	0.17	0.12		0.71	Chairman
E. Raedene Combs	Associate Professor	0.50			0.50	Family Economics and Housing
Jean Memken	Assistant Professor	0.37			0.63	Housing
Entomology						
Roger E. Gold	Professor	0.55	0.26	0.19		Head, Urban Entomology
Mary Ellen Dix	Assistant Professor				USDA	Shelterbelt Insects
Thomas O. Holtzer	Associate Professor	0.80		0.20		Crop Insects and Spidermites
Tony Joern	Associate Professor				1.00	Insect Ecology
J. Ackland Jones	Associate Professor	0.25		0.75		Shelterbelt Insects
S. Dean Kindler	Professor				USDA	Forage Crops Insects
George R. Manglitz	Professor				USDA	Forage Insect Investigations
Z B Mayo	Professor	0.80		0.20		Cytogenetics of Greenbugs
Lance J. Meinke	Assistant Professor	0.80		0.20		Corn Insects
James J. Petersen	Professor				USDA	Livestock Entomology
Kenneth P. Pruess	Professor	0.63		0.37		Aquatic Insects
Brett C. Ratcliffe	Associate Professor				1.00	Insect Curator
Gustave D. Thomas	Professor				USDA	Livestock Entomology
Environmental Programs						
Shripat T. Kamble	Associate Professor	0.25	0.75			Environmental Entomology
Food Science and Technology						
Lowell D. Satterlee ¹	Professor	0.40	0.34	0.26		Head, Food Peptide Chemistry
Charles E. Walker	Professor	0.40	0.34	0.26		Interim Head, Cereal Technology
R. C. Anantheswaran	Assistant Professor	0.80			0.20	Food Engineering
Lloyd B. Bullerman	Professor	0.50	0.10	0.40		Food Microbiology
Susan B. Cuppett	Assistant Professor	0.60		0.40		Food Lipids
Glenn W. Froning	Professor	0.60		0.40		Poultry Products
Michael B. Liewen	Assistant Professor	0.30	0.70			Food Microbiology
R. Burt Maxcy	Professor	0.60		0.40		Food Microbiology
John Rupnow	Associate Professor	0.39		0.61		Food Biochemistry
Khem M. Shahani	Professor	0.45		0.05		Food Chemistry

(continued)

Faculty

	Rank	Rsch	Ext	Tch	Other	Area of Responsibility
<i>(Food Science and Technology....)</i>						
Randy L. Wehling	Assistant Professor	0.50	0.30	0.20		Food Processing
Michael G. Zeece	Assistant Professor	0.60		0.40		Food Protein Chemistry
Forestry, Fisheries and Wildlife						
Gary L. Hergenrader	Professor	0.05	0.07	0.15	0.73	Head
James R. Brandle	Associate Professor	0.90		0.10		Forestry
Ronald M. Case	Professor	0.30		0.70		Wildlife
Stephen G. Ernst ²	Assistant Professor	0.75	0.25			Forestry
Mark O. Harrell	Assistant Professor	0.15			0.85	Nebraska Forest Service
Ronnie J. Johnson	Associate Professor	0.31	0.43		0.26	Wildlife
Michael R. Kuhns ²	Assistant Professor	0.25	0.75			Forestry
Edward J. Peters	Associate Professor	0.30		0.70		Wildlife
David F. VanHaverbeke	Professor				USDA	Forestry
Horticulture						
Roger D. Uhlinger	Professor	0.43	0.33	0.24		Head
Dermot P. Coyne	Professor	0.96		0.04		Vegetable Breeding
Jay B. Fitzgerald	Associate Professor	0.21	0.24	0.55		Ornamentals
William A. Gustafson	Associate Professor	0.25	0.75			Fruit and Nut Crops
Edward J. Kinbacher	Professor	0.35		0.65		Turf Physiology
Ralph E. Neild	Professor	0.39	0.56	0.05		Horticulture
Ellen T. Paparozzi	Assistant Professor	0.35		0.65		Ornamentals
Terrance P. Riordan	Associate Professor	0.89		0.11		Turf Breeding
Sotero S. Salac	Associate Professor	0.81		0.19		Ornamentals
Robert C. Shearman	Associate Professor	0.59	0.25	0.16		Turf
Human Development and the Family						
Helen Sulek ²	Associate Professor	0.25	0.10		0.65	Interim Chairman
John D. DeFrain	Associate Professor	0.50			0.50	Rural Family Crisis
Violet Kalyan-Masih	Professor	0.59			0.41	Cognitive Development (Piaget)
Patricia Knaub	Associate Professor	0.27			0.73	Dual Career Families - Remarriage
Lois D. Schwab	Professor	0.75			0.25	Rehabilitation of Handicapped Women
John C. Woodward	Professor	0.48			0.52	Loneliness and Solitude
Human Nutrition and Food Service Management						
Hazel Fox	Professor	0.50	0.10		0.40	Chairman
Nancy M. Betts	Assistant Professor	0.35			0.65	Nutrition
Anna M. Brenner	Associate Professor	0.25			0.75	Food Service Management
Audrey L. Hay	Assistant Professor	0.30			0.70	Food Service Management
Constance Kies	Professor	0.70			0.30	Nutrition
Phyllis Staats	Assistant Professor	0.32			0.68	Foods
Northeast Research and Extension Center						
Donald B. Hudman ²	Professor	0.23	0.69			Director
Cal J. Ward ¹	Professor	0.23	0.69	0.08		Director
John F. Witkowski	Associate Professor	0.50	0.50			Interim Director, Entomology
Michael C. Brumm	Associate Professor	0.50	0.50			Animal Science

	Rank	Rsch	Ext	Tch	Other	Area of Responsibility
<i>(Northeast Research and Extension Center....)</i>						
William L. Kranz	Assistant Professor	0.25	0.75			Ag. Engineering
Terry L. Mader	Assistant Professor	0.50	0.50			Animal Science
Russell S. Moomaw	Professor	0.49	0.51			Agronomy
Charles Shapiro	Assistant Professor	0.50	0.50			Agronomy
David P. Shelton	Associate Professor	0.50	0.50			Ag. Engineering
Panhandle Research and Extension Center						
Robert D. Fritschen	Professor	0.42	0.50		0.08	Director
Burton A. Weichenthal	Professor	0.50	0.50			Associate Director
Frank N. Anderson	Associate Professor	0.50	0.50			Agronomy
Dale M. Groteleuschen	Assistant Professor	0.50	0.50			Diagnostic Veterinary Science
Arthur F. Hagen	Associate Professor	0.25	0.75			Entomology
John L. Havlin ¹	Assistant Professor	0.50	0.50			Agronomy
Eric D. Kerr	Professor	0.50	0.50			Plant Pathology
Lenis Nelson	Professor	0.75	0.25			Agronomy
David S. Nuland	Assistant Professor	0.25	0.75			Horticulture
Robert O'Keefe	Professor	0.80	0.20			Horticulture
Patrick E. Reece	Assistant Professor	0.50	0.50			Agronomy
James G. Robb	Assistant Professor	0.50	0.50			Agricultural Economics
Ivan G. Rush	Professor	0.25	0.75			Animal Science
John A. Smith	Assistant Professor	0.50	0.50			Agricultural Engineering
Albert Weiss ¹	Associate Professor	1.00				Agricultural Meteorology
Robert G. Wilson	Professor	0.50	0.50			Agronomy
C. Dean Yonts	Instructor	0.50	0.50			Agricultural Engineering
Plant Pathology						
Anne K. Vidaver	Professor	0.75	0.15	0.10		Head
Michael G. Boosalis	Professor	0.66	0.19	0.15		Root Diseases and Mycorrhizae
Myron K. Brakke	Professor				USDA	Virus Diseases
Stan G. Jensen	Associate Professor				USDA	Corn and Sorghum Diseases
Leslie C. Lane	Associate Professor	0.85		0.15		Virus Diseases
Willem G. Langenberg	Professor				USDA	Virus Diseases
James Partridge	Associate Professor	0.80		0.20		Corn and Sorghum Stalk Rot
Glenn W. Peterson	Professor				USDA	Tree Diseases
Thomas O. Powers	Assistant Professor	0.85		0.15		Nematology
Jerry W. Riffle	Professor				USDA	Tree Diseases
Gurmel S. Sidhu	Assistant Professor	0.85		0.15		Corn and Sorghum Diseases
James R. Steadman	Associate Professor	0.90		0.10		Epidemiology of Vegetable Diseases
James L. Van Etten	Professor	0.90		0.10		Microbial Physiology
John E. Watkins	Associate Professor	0.25	0.75			Small Grains, Turf and Alfalfa
South Central Research and Extension Center						
Charles L. Stonecipher	Professor	0.14	0.78		0.08	Director
Benjamin L. Doupnik, Jr.	Professor	0.50	0.25		0.25	Plant Pathology
Dean E. Eisenhauer	Associate Professor	0.49	0.51			Agricultural Engineering
Roger Elmore	Assistant Professor	0.50	0.50			Agronomy
Richard Ferguson	Assistant Professor	0.50	0.50			Agronomy
Donald G. Levis	Associate Professor	0.25	0.75			Animal Science

(continued)

Faculty

	Rank	Rsch	Ext	Tch	Other	Area of Responsibility
<i>(Southeast Research and Extension Center....)</i>						
Leroy Peters	Professor	0.50	0.50			Entomology
Fred W. Roeth	Professor	0.50	0.50			Agronomy
Roger Selley	Associate Professor	0.25	0.75			Agricultural Economics
Southeast Research and Extension Center						
Loyd L. Young	Professor	0.05	0.87		0.08	Director
Textiles, Clothing and Design						
Joan Laughlin	Professor	0.37	0.11		0.52	Chairman, Textiles
Audrey Newton ¹	Professor	0.17			0.33	Clothing for Special Needs
Veterinary Science						
John A. Schmitz	Professor	0.65	0.15	0.20		Head
Gary A. Anderson	Assistant Professor	0.90		0.10		Research Pathology
Edgar Clemens	Associate Professor	0.50		0.50		Physiology
Earl O. Dickinson	Professor	0.75		0.25		Diagnostic/Research Pathology
Alan R. Doster	Associate Professor	0.93		0.07		Diagnostic Pathology
Gerald E. Duhamel ²	Assistant Professor	0.85		0.15		Diagnostic/Research Pathology
E. Denis Erickson	Professor	0.90		0.10		Diagnostic Bacteriology
Donald L. Ferguson	Professor	0.86		0.14		Parasitology
Merwin L. Frey	Professor	0.69		0.06		Research Virology
Alex Hogg	Professor	0.07	0.88	0.05		Swine Diseases
Clayton L. Kelling	Associate Professor	0.25				Research Virology
Rodney A. Moxley	Assistant Professor	0.93		0.07		Diagnostic/Research Pathology
Rebecca Nichelson ²	Instructor	0.40		0.60		Physiology
Fernando Osorio	Assistant Professor	1.00				Diagnostic/Research Virology
Marvin B. Rhodes	Professor	1.00				Immunochemistry
Duane N. Rice ²	Associate Professor	0.07	0.87	0.06		Dairy and Beef Cattle Diseases
Norman R. Schneider	Associate Professor	1.00				Diagnostic/Research Toxicology
S. Srikumaran	Assistant Professor	1.00				Research Immunology
R. Gene White	Professor	0.10	0.25	0.15	0.50	Beef Cattle Diseases
West Central Research and Extension Center						
Lavon J. Sumption	Professor	0.46	0.47	0.07		Director
Donald B. Hudman ¹	Professor	0.50	0.50			Associate Director
John B. Campbell	Professor	0.50	0.50			Entomology (Livestock Insects)
Donald C. Clanton	Professor	1.00				Animal Science (Beef)
Richard Clark ²	Associate Professor	0.25	0.75			Agricultural Economics
David M. Danielson	Professor	1.00				Animal Science (Swine)
Gene H. Deutscher	Associate Professor	0.28	0.72			Animal Science (Beef)
Philip H. Grabouski ¹	Assistant Professor	0.50	0.50			Agronomy (Crops)
Gary W. Hergert	Associate Professor	0.40	0.60			Agronomy (Soil Science)
Jerre Johnson	Associate Professor	1.00				Veterinary Science
Norman L. Klocke	Assistant Professor	0.50	0.50			Agricultural Engineering
Dale T. Lindgren	Associate Professor	0.50	0.50			Horticulture
James T. Nichols	Professor	0.50	0.50			Agronomy (Range Management)
Paul T. Nordquist	Associate Professor	1.00				Agronomy (Sorghum Breeding)
Gail A. Wicks	Professor	0.50	0.50			Agronomy (Weed Science)

Research Highlights



100th

Annual Report

**University of Nebraska
Agricultural Research Division**

Research Highlights

Agricultural Biochemistry

Nitrogen fixation is a process by which nitrogen is taken from the air and reduced to ammonia, a form of nitrogen usable by plants. Legumes have root nodules which encapsulate bacteria to perform nitrogen fixation. In effect, the leguminous plant supplies the bacteria with nutrients and oxygen and the bacteria reciprocates by providing the plant with nitrogen fertilizer. Oxygen inhibits nitrogen fixation by the bacteria so free oxygen must be excluded in nodules. However, the bacteria need oxygen to live and provide the energy needed to produce ammonia. Legumes produce a molecule called leghemoglobin. It resembles hemoglobin which is the red, oxygen-binding protein in red blood cells. Leghemoglobin, which is also red, binds oxygen within nodules. This provides a store of oxygen needed by the bacteria and keeps the oxygen in a bound, rather than a free state.

In one agricultural biochemistry project, factors that affect the efficiency of oxygen binding to leghemoglobin were investigated. The efficiency of this process affects the efficiency of the nitrogen fixation process. If these processes are understood, it seems possible to find ways to increase the amount of nitrogen fixed by legumes in the field.

As soybean plants approach maturity, their root nodules undergo senescence and the nodules stop fixing nitrogen before the plant dies. If the nodules could be induced to continue fixing nitrogen, two possible advantages could accrue. The excess nitrogen might increase crop yield or be left as a crop residue that would reduce the amount of fertilizer needed for a crop of corn or sorghum that might follow.

Another project in the Department of Agricultural Biochemistry is aimed at determining conditions that precipitate nodule senescence. By understanding these conditions it may be possible to delay nodule senescence, which if only for a day or two, could yield a significant economic benefit.

Agricultural Economics

The use of cash flow analysis as a tool in credit decisions was examined. Inflation was identified as causing short-run cash deficits for many firms that have borrowed funds for capital investments. However, from the long-run point of view, these firms could be making substantial progress on lowering their debt levels and building their earning capacity. The inflation problem combined with other weaknesses inherent in short-run cash flow analysis suggest that exclusive reliance on the cash flow statement

alone in evaluating investments would result in errors in the selection of the most appropriate investment alternative and/or the most credit-worthy borrowers. Long-run investment decisions should be judged on long-run performance criteria without the distortion of inflation in order to select the most appropriate investment alternative.

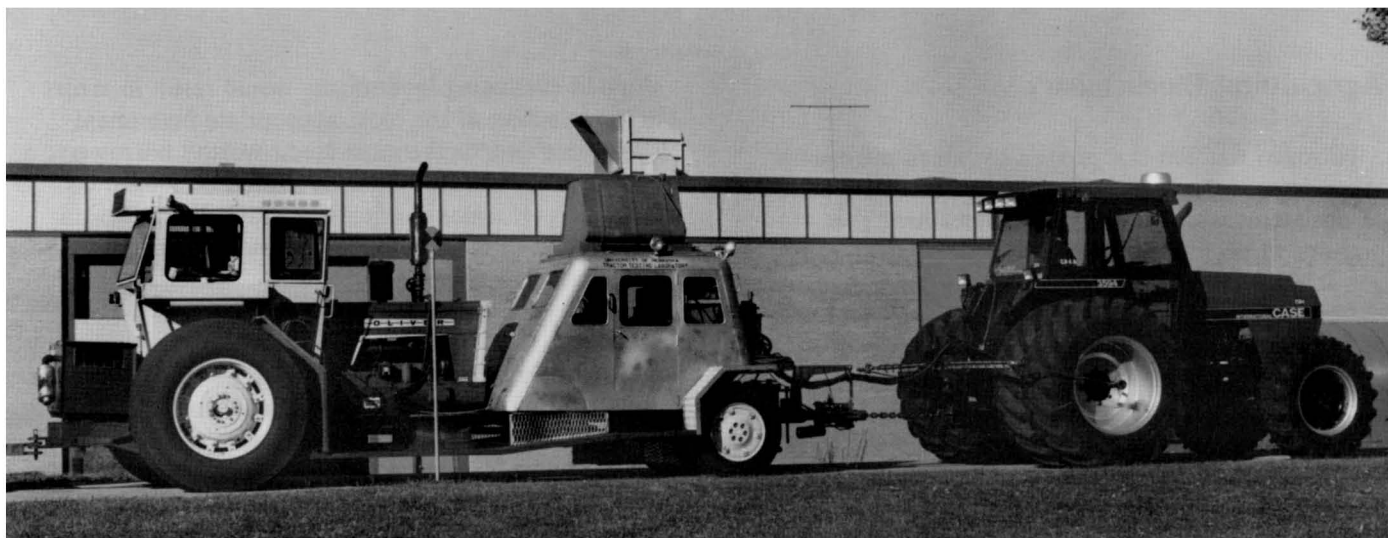
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The interaction between the feed grain and livestock subsectors in Nebraska was compared to the rest of the United States. Several implications relative to the impact of feed grain policy were disclosed. It was demonstrated that increases in the export demand for grains due to national farm policies will increase cattle placements in commercial feedlots, but result in relatively lower placements in farmer operated feedlots. A greater financial impact occurs on ranchers than on cattle feeders when grain exports increase. The rancher suffers a decline in the value of the cattle breeding resources, in particular the cow herd, and also suffers a lower value for rangeland. Adjustments in Nebraska due to increased exports of grain differ somewhat from those which occur in other regions of the United States due in part to the important role of ranching in the state.

Agricultural Engineering

Degradation of groundwater quality due to agricultural practices is receiving much attention in the United States and internationally. The buildup of nitrate in the groundwater is a primary concern. The Agricultural Engineering Department has had a long-standing program regarding irrigation and nitrogen management with the objective of producing high crop yields while minimizing percolation of nitrate into the groundwater. Research has evaluated the effects of irrigation scheduling on the fate of nitrogen to illustrate the importance of nitrate in the groundwater as a source of nitrogen. Field research has been augmented with computer models to describe how nitrate moves in the soil and how irrigation and nitrogen management affect the rate of nitrate leaching. Results show that some nitrate leaching is inevitable on sandy soils, but that management can be fine-tuned to minimize nitrate losses and still produce high yields. Current research is underway to develop methods to schedule nitrogen applications to match crop needs, to study the interaction of nitrogen and water stress for areas of the state faced with limited irrigation water, and to develop methods to predict the rate of accumulation of nitrate in the groundwater. We will also ex-

(continued)



Drawbar testing at the world-famous University of Nebraska Tractor Testing Laboratory.

(Agricultural Engineering...)

periment with new technology to more quickly determine the nitrogen status of crops and soils. These efforts should help agriculture more effectively use an essential crop nutrient, without polluting the environment.

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Microprocessor-based, electronic image processing is providing a new and rapid means of obtaining basic information concerning plant growth and development. A dual television camera system has been tested as a means of acquiring three-dimensional plant architectural measurements, using principles of stereoscopic photogrammetry. These nondestructive measurements of the canopy include *in situ* leaf area, stem length, stem diameter, and leaf orientation angles. These data are used to build a composite picture of canopy structure and light intercepting ability. Other imagery applications include rapid measurement of surface residue levels as a result of various tillage operations from carefully controlled, still photography. Still frames are automatically analyzed by special software written for a personal computer equipped with a television camera and special interface card. With this system, more than 200 residue frames can be reliably analyzed in an hour. These data will help to evaluate erosion potentials as a result of various tillage operations.

Agronomy

The Nebraska Sandhills (52,000 km²) is the largest dune formation in the western hemisphere. Topography is rolling, and the sandy soils have low organic matter and high infiltration rates. Conversion of the

tallgrass prairie to irrigated cropland accelerated after the introduction of center pivot systems. The Ogallala aquifer provides adequate water, but poor site selection and increasing production costs have resulted in abandonments. Revegetation of these critical areas represents a unique challenge.

Germinator, greenhouse, and field trials were initiated in 1982 and are continuing today. Sites near Milburn and Ainsworth have been used to evaluate soil characteristics of abandoned sandy cropland, seeding mixtures of native grasses and monocultures of native and introduced grasses; seeding rates; seedbed preparation including clean till, stubble and seeded cover crop; types of drills; aerial seeding of coated and uncoated seeds; and supplemental water during the seeding year. Liming did not affect seedling density or frequency in field trials. Greenhouse studies determined that mycorrhizae populations at the research site were sufficient to provide adequate infection for grass establishment. Weed competition, particularly sandbur on dryland sites, was a major factor influencing seedling establishment. Germination studies documented that sandbur plants exhibited an allelopathic effect inhibiting germination and radicle elongation of seeded species. This suggested that pre-emergent herbicides offered sandbur control; however, herbicide antidotes would have to be used to protect the seeded species. Selected combinations of pre-emergent herbicides and antidotes have resulted in successful seedling establishment in greenhouse trials. Research to date has identified several revegetation practices that can provide successful stand establishment within various management, economic, and ecological strategies.

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The essence of western Nebraska research is to diversify farming by introducing grain sorghum (and pearl millet later) into a sorghum-fallow-wheat system. This permits two crops in three years compared to the two wheat crops in four years in the traditional wheat-fallow system. The first cycle of yield testing under several tillage systems gave combined wheat and sorghum yields over three years which are equal to or exceed combined wheat yields over a four-year period. Water use per pound of grain produced was clearly superior in the first cycle of the three-year system. Long-term feasibility of this system will have to be evaluated over several years along with economic analyses of tillage system costs plus wheat and sorghum grain prices.



The Agronomy Department is conducting research to reclaim former pivot sites in the Sandhills with perennial grasses.

Adaptation of grain sorghum to the Panhandle area has resulted from extensive commercial and university screening of sorghums to fit the dry, cool night climate of the Sidney area. Breeding germplasm imports from cool, high elevations in Mexico have been invaluable. About 600 new food quality hybrids were tested this year. Smaller tests the last two years were encouraging. This drought stress research has required testing for tolerance to cool night temperatures.

A large drought screening effort for central and eastern Nebraska has evolved over the last 10 years.

The screening technique is based on basic physiology research into the timing and nature of heat and drought induced floret damage in sorghum. The applied screening was mostly in western Kansas. Results have been unusually encouraging. A new line is yielding twice as much as an old standard, CK 60, under stress at Garden City, Kansas. The first release of stress-resistant germplasm will be in 1987.

Both the Sidney program and the central and eastern Nebraska programs illustrate the long-range nature of physiology research required to achieve improved crop production.

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Research is being conducted to assess the effects of reduced tillage on herbicide availability and dissipation in soil. Research has emphasized situations where these practices have been recently introduced. In these instances the presence of crop residue on the soil surface and changes in moisture and temperature status of the underlying soil have the greatest impact on herbicide availability and dissipation. Among the herbicides under study are atrazine, cyanazine, metribuzin, alachlor and metoachlor, which are commonly used in corn or soybean production.

Animal Science

Poor sow productivity caused by small litters continues to be a problem for swine producers. Selection for larger litters has been relatively ineffective in both commercial producer and research herds because number born per litter is a lowly heritable trait. Research by the Animal Science Department has shown that number born per litter is determined primarily by the sow's ovulation rate and uterine environment. These traits are negatively related, both genetically and environmentally. A genetic line was selected to have an ovulation rate 3.5 to 4 eggs higher than most swine stocks. However, number of pigs born increased very little due to higher fetal mortality in the high ovulating line. The line was then selected for litter size at birth which, in this stock, means it was selected for higher embryo and fetal survival rate. After seven generations, litter size is about one pig per litter more than in high ovulation rate swine selected randomly. This is one of the first examples that litter size can be improved by selection and leads to optimism that reproductive efficiency of the sow herd can be improved genetically.

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Much attention is being focused on reducing the fat content of red meat to improve consumer acceptance

(continued)

Research Highlights

(Animal Science....)

and to avoid wasting feed for deposition of unwanted fat in meat animals. Two recent experiments were conducted at the U.S. Meat Animal Research Center at Clay Center by USDA and University of Nebraska scientists to examine the effect on feed costs which can be expected from genetic reduction of body fat content in beef cattle and sheep. The cattle experiment involved measurement of fasting body heat output (maintenance) and body chemical composition at birth, 3, 7, 10 and 14 months of age and feed consumed from 7 to 14 months in beef heifers of three biological types (Hereford, Charolais and Simmental). Similar measurements were studied in non-pregnant, non-lactating ewes of seven biological types, after feeding at either full or maintenance levels for six weeks. In both experiments, feed required for maintenance was closely associated with weight of lean tissue, especially of visceral organs, but not with body fat. Also, feed energy above maintenance required per pound of protein gain was more than twice that for fat gain. However, feed per pound of lean tissue gain was still much less than for fat gain because of the high water content (75 percent) in lean tissues compared with fat. These results indicate that genetic reduction in body fat in cattle or sheep will increase maintenance requirements per unit of liveweight in both adult and growing animals, but reduce the above-maintenance feed costs per pound of live weight gain in market animals. Thus, fatter genetic types are more efficient as female breeder replacements and use of leaner sire types of market animals (but not replacement females) will permit the greatest reduction in total feed cost per pound of lean beef or lamb production. However, it will not reduce feed cost per pound of liveweight appreciably. Market prices for slaughter animals must favor higher lean content to provide the economic incentive for reducing fatness in beef and lamb production.

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In order for ruminants (cattle and sheep) to make maximum use of Nebraska's forage resources, it is sometimes necessary to supply additional dietary energy as a supplement to forages. This has usually been in the form of grain. The grain adds energy but the starch in the grain depresses the digestion of the forage fiber. Research has recently given an answer to the dilemma. Soybean hulls, the seed coat which is removed in the processing plant before the oil is extracted, are almost all fiber. Unlike forage fibers, soyhull fiber is almost completely digested by ruminants. Corn bran, produced in the wet milling of corn (corn sweeteners and alcohol are the primary products), has similar characteristics. These two highly digestible

fibers can be better energy supplements than grain because there is no negative effect on the fiber digestion of the forage. In addition, over-consumption does not create problems often observed when animals overconsume supplemented grain. Feeding trials have shown that soyhulls and corn bran are at least equal to grain in value as energy supplements to forage. This technology has developed a needed market for these byproducts and, at the same time, provided a safer and more economical energy supplement for beef cattle producers. High lactating dairy cows receive substantial grain supplements to supply energy for milk production. High grain intake reduces fiber digestion and can cause dairy cows to go off feed as observed in beef cattle. An additional unique problem in dairy cows is reduced milk fat test. Recent research indicates that highly digestible fiber in soyhulls and corn bran aids in solving these problems related to high grain feeding of the dairy cow.

Biometrics and Information Systems Center

Computer procedures were developed for streamlining the analysis of data from switchback designs in dairy nutrition trials. Various procedures were also initiated to apply balanced incomplete block designs to account for experimental constraints in agricultural engineering settings. Examination of different rates and sources of repellents on rodent control in corn fields provided useful recommendations. The interactions of rates and sources with years has modified these recommendations to account for different environmental conditions.

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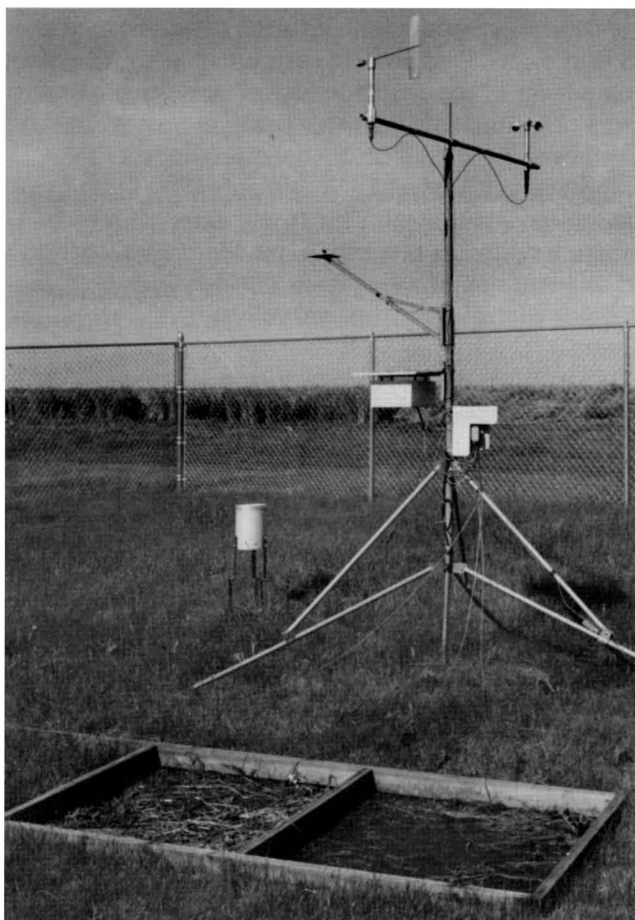
Work continues on a regional research project designed to help researchers determine the most accurate and cost-effective experimental design and analysis strategy. Recent directions include the identification of designs which are relatively insensitive to violations of classical model assumptions and the testing of mixed model computation algorithms which exploit recent advances in computing. Joint research with animal science includes modeling the feed consumption process of ruminant animals.

Center for Agricultural Meteorology and Climatology

Several micrometeorological techniques for accurately measuring crop photosynthesis and water demand have been developed and tested at the University of Nebraska's Agricultural Meteorology Laboratory at the Agricultural Research and Development

Center at Mead. During the past three years, employing a prototype rapid response CO₂ sensor built by the Lawrence Livermore National Laboratory, the eddy correlation technique has been used to accurately measure carbon dioxide fluxes. This is a valuable tool in developing and testing techniques for improving crop water use efficiency (photosynthesis/evapotranspiration).

These techniques are applicable not only to agricultural crops but to other types of terrestrial ecosystems as well. Such measurements are needed to reduce the uncertainties that now exist concerning the role of terrestrial ecosystems in the global carbon balance. Eddy correlation systems have already been applied to measurements of carbon dioxide flux in a deciduous forest ecosystem near Oak Ridge, Tennessee.



Weather information relevant to crop and livestock producers is being collected by equipment like this as part of the Automated Weather Data Network.

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Careful monitoring of the weather to collect information relevant to crop and livestock producers is being done by the Automated Weather Data Network, a

network of remote weather stations that is used by the Center to automatically collect weather data. This network, in operation since 1981, collects weather data just hours after the fact from remote stations. AWDN stations routinely measure windspeed and direction, solar energy, air temperature, humidity, soil temperature and precipitation. Other variables such as photosynthetically active radiation can be measured for research projects.

Technological advances in electronics make it possible for a computer at the Center to call stations daily, retrieve data over the telephone lines, check it for quality, and transmit it to AGNET where a second archive is maintained for public access. Additional data from National Weather Service computers is collected and furnished to AGNET daily. AGNET subscribers have made extensive use of the weather data through more than 13,000 accesses per year.

Consumer Science and Education

Data were collected to determine the attitudes of home builders and loan officers toward the construction and financing of earth-sheltered dwellings and houses with passive and active solar systems. The identity of existing institutional barriers was a major concern. Findings point to the importance of building passive solar systems, although few home builders had actually built this kind. Loan officers were about evenly split on the question of whether to support or oppose financing for earth-sheltered housing.

Entomology

A laboratory procedure has been developed for determining the toxicity of various chemicals to spider mites and other small arthropods such as aphids. By using this procedure, the toxicity of 12 chemicals used for insect and mite control in corn were determined for two species of mites. The results indicate there are important differences among products and between mite species. These differences should be considered by farmers when making management decisions. A joint study with researchers from four other states tested three chemicals. It showed that there are important geographical differences in toxicity to the spider mites. Further work using the procedure is underway, including experiments with aphids. The present studies are aimed at providing insights into some of the underlying mechanisms affecting the toxicity of various chemicals.

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As part of the Pesticide Impact Assessment Pro-

(continued)

Research Highlights

(Entomology....)

gram, a study to assess human exposure to pesticides began two years ago. It involved commercial pest control operators who treated homes with a dilution of chlordane and heptachlor for subterranean termite control. Twenty-five operators were monitored for dermal and inhalation exposure. The ambient air of 19 chemically-treated homes was monitored for up to six months to evaluate exposure to residents. This research indicated there was minimal risk in terms of acute exposure of chlordane and heptachlor to pesticide applicators and residents.

Environmental Programs

The practice of chemigation — applying agricultural chemicals in irrigation water — is becoming increasingly widespread. An interdisciplinary team of IANR scientists is in the second year of a five-year project to intensely study this practice. Simulated agricultural chemical backflows with nontoxic tracer substances are used to study chemical movement in an aquifer and evaluate various “cleanup” methods. A 160-acre field at the South Central Research and Extension Center at Clay Center has been divided into a grid of plots to study the effects of different tillage, planting, irrigation and chemical treatment practices. Another

dimension of the study is an extended evaluation under laboratory and field conditions of injection and antipollution equipment systems for applying chemicals through irrigation. The study is being funded by a \$1 million grant from the Burlington Northern Foundation.

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Institute of Agriculture and Natural Resources scientists are continuing their collaboration with University of Nebraska Medical Center researchers under the Pesticide Impact Assessment Program. A volunteer group of 89 agricultural producers and “controls” from two east central Nebraska counties are cooperating in a project to examine “planting time flu” syndrome. UNMC researchers are using highly sensitive procedures to analyze blood samples to find evidence of pesticide exposure. In another component of the Pesticide Impact Assessment Program, 25 commercial pest control operators were monitored for dermal and inhalation exposure to chlordane and heptachlor, commonly used for subterranean termite control. This study, along with a six-month monitoring program in treated homes, indicated minimal risk of exposure to the chemicals both to the pest control operators and residents of treated homes.

Food Science and Technology

The potential for commercial mushroom production in Nebraska is being studied by the Food Processing Center as part of a project funded by the Nebraska Department of Economic Development. Work includes developing the expertise and research program necessary to give technical support to a mushroom growing and processing industry. Specific activities include identifying suitable mushroom cultures, developing procedures for potential growers, and studying ways of extending the shelf-life of fresh mushrooms. The possibility of producing mushroom tissue by fermentation is also being studied for use in processed foods.

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Amaranth is a broad-leaved plant which produces an edible cereal-like grain under arid conditions and has an excellent nutritional profile. Current research on amaranthus seed includes: 1) the isolation and determination of the stability of antinutritional factors; 2) protein complementation using amaranth blends and; 3) extrusion processing of such blends to improve sensory and nutritional qualities.



Pesticides are dangerous to applicators. Research is being conducted to analyze pesticides to determine minimal risk of exposure.

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Another area of recent emphasis is the development of ready-to-eat breakfast cereals from Nebraska grown grains. In one case, the Food Processing Center assisted a start-up company in developing an extruded, star-shaped cereal made from high lysine corn, which is nutritionally superior to normal corn. The product has been introduced to the market under the name "Husker All Stars." A second project involved the potential uses of grain sorghum (milo) for American-style foods. It has resulted in development of a prototype breakfast flake code-named "Captain Milo." It is not in commercial production, although several companies have expressed an interest in it. It also has potential in Africa, Asia, and Central America where sorghum is commonly used as a human food and in countries "westernizing" their diets.

Forestry, Fisheries and Wildlife

Conservation tillage farming has increased markedly in recent years. These reduced tillage farming systems leave plant residue on the soil surface to benefit both agriculture and wildlife. Residue helps conserve soil and water and in some fields, especially no-till fields, the residue provides birds with nesting sites. However, small rodents also thrive in conservation tillage fields and at times cause damage to newly planted corn by digging and consuming the seed.

A two-year study in eastern and western Nebraska found that rodent damage in no-till fields resulted in stand losses that averaged from about 0 to 11 percent. The damage amounts were variable among fields and years. Nine kinds of rodents were captured in these fields including five which were implicated in damage. On the beneficial side, however, these rodents also consumed crop-damaging insects including wireworms and cutworms as well as weed seeds and waste grain that could produce unwanted volunteer crops during the following growing season. Because one cutworm can destroy three to four corn plants, each cutworm consumed can mean saving several plants.

Studies are underway to find an effective and safe way to prevent this rodent damage. In one approach, two chemicals, thiram and methiocarb, are being evaluated as potential seed-treatment repellents. Field and laboratory tests over four growing seasons show that both chemicals, if applied at proper rates, effectively repel 13-lined ground squirrels. Laboratory experiments show that they also repel deer mice. However, when corn seeds germinate and become soft, ground squirrels and possibly other rodents often remove the seed coat and therefore the repellent. Laboratory

studies with deer mice indicate that adding a special odor cue to the repellent seed treatments may solve this by repelling rodents before they sample the seed.

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Zimmerman pine moths are some of the most serious insect pests of pine trees in Nebraska. In their larval stage these insects damage trees by tunneling under the bark of the trunk and large branches. Heavily infested trees often are severely stunted and deformed and sometimes are killed. For many years it was assumed that there was only one species of Zimmerman pine moth in Nebraska. Insect control with pesticides was difficult and often not successful, and no resistant species of pine had been identified. A recent study, however, determined that three species of Zimmerman pine moth, not just one, are present in the state. These species differ significantly in their life cycles. Additional studies have developed effective chemical control strategies, identified jack pine as the pine species in Nebraska most resistant to the insects, and determined that water-deficiency stress in the trees increases the chance that the trees will become infested and damaged. These studies and the ongoing research of Zimmerman pine moths are aimed at developing a comprehensive management strategy to reduce damage.

Horticulture

Weed control in squash and pumpkins has been a chronic problem for growers. Trifluralin (Treflan) is a very effective herbicide which is used extensively in vegetable crop production but cannot be used in squash production because squash is sensitive to injury by the chemical. Some resistance to Treflan injury was discovered several years ago by a UNL horticulture student. During this past year, a bioassay test for screening squash for resistance to Treflan injury was successfully developed. If the resistance proves to be stable, a valuable contribution will have been made to commercial growers of vine-type squashes and pumpkins.

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Increasing costs and decreasing availability of water for use in recreational and residential turf plantings are concerns being addressed by turf scientists. One approach is to select clones of warm season turf-grasses (specifically buffalograss) that may have good turf characteristics. These warm season grasses will be better adapted to the rigors of the Great Plains environment and should be able to persist in situations where water is limited. Preliminary efforts include ex-

(continued)

Research Highlights

(Horticulture....)

ploring the Great Plains for suitable selections of buffalograss. These have now been propagated and are being evaluated under controlled conditions at the Nebraska Agricultural Research and Development Center near Mead. Preliminary observations reveal great diversity in height, color, rate of spread and general turf quality.

Department of Human Development and the Family

Rural Nebraska families, while sometimes experiencing serious economic distress, have reported no decline in the quality of family relationships in the home. While nearly two-thirds of a random sample of more than 300 rural Nebraska families reported that net spendable income had decreased, three-fourths reported a "perfect score" on being committed to each other, a measure of family cohesion. On a scale of 1 to 10, a mean of 8.8 was attained on the degree of family strengths maintained within the family unit. While economic distress has been apparent, there has been no decline among subjects in this study in the quality of family relationships.

This is not to say that Nebraska families are immune to stresses associated with changing lifestyle patterns in adapting to various societal problems impacting on most of our population. Women, particularly those who are entering the work force and who yet have children at home, face the potential of significant role conflict in attempting to continue in their more traditional roles of mother, wife and homemaker, and in their adjustment to working outside the home.

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Another study of families in Nebraska involved the role of the working mother. Researchers found that women who interrupted their careers for short periods of time (two years or less) to have or care for children seemed to have more role conflict than women who had not interrupted their careers or who had interrupted them for longer periods of time. Those women experiencing role conflict possibly had not given as serious consideration to their decision to assume an additional major role and thus had not committed themselves as seriously to making such a significant change in their overall lifestyle.

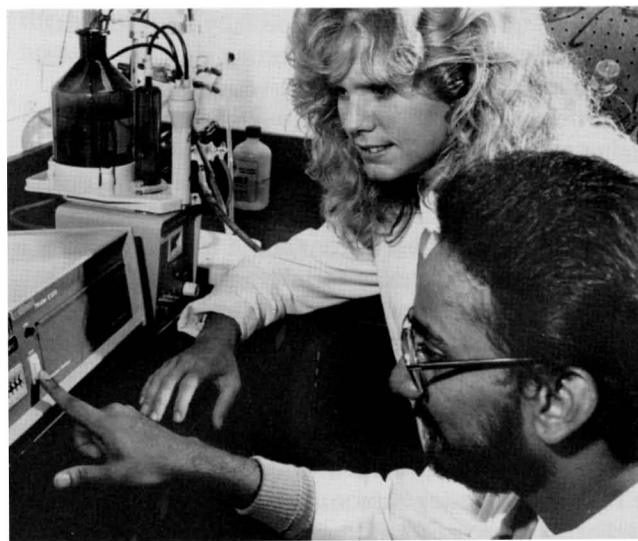
Human Nutrition and Food Service Management

Safety, eating quality and energy used in preparation of poultry are being studied. The presence of

ready-to-roast stuffed fresh turkey, chicken and duck in the supermarket prompted a survey to assess consumer knowledge and handling practices in relation to poultry. Survey results indicated less than one percent of poultry is purchased pre-stuffed. Also, persons over 55 years of age are more likely than younger consumers to stuff turkeys and fill the turkey cavity completely, making it more difficult for heat to penetrate. Microbiological studies are planned to determine the degree of bacterial destruction when a pre-stuffed bird is cooked.

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Quality and cost control methods used in food service systems also are being studied. Control methods are important tools for the food service manager in maintaining a cost-effective operation. Errors in assembling patient diet trays in a hospital or nursing home influence patient satisfaction, nutrition education, and food cost. Employee in-service training programs targeting rationale and modifications of special diets were found to help decrease the number and type of errors in assembling patient trays. Fewer errors result in increased patient satisfaction, improved employee morale, and lower food costs.



Accurate analysis of samples is critical to research in Human Nutrition.

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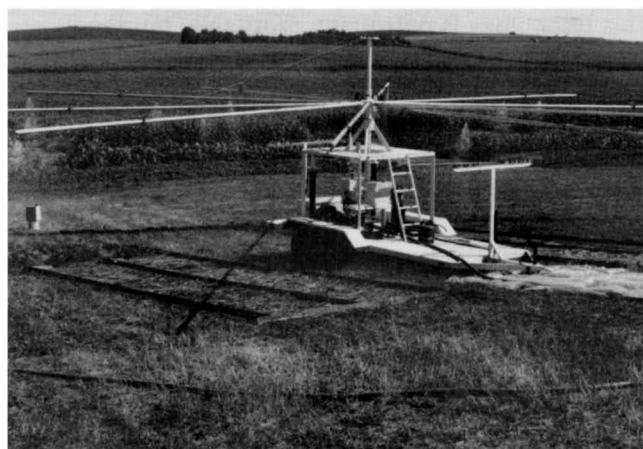
Because of the high incidence of osteoporosis among elderly women in the United States, all women are being encouraged to increase their intake of calcium. Since these levels are considerably higher than those supplied by usual American diets, calcium supplements are being used with increased frequency.

Calcium utilization from several commercially available calcium supplements and milk were evaluated through the feeding of constant, laboratory-controlled diets to human adults. Results indicated that calcium from calcium carbonate, the most commonly sold calcium supplement, salt, was more poorly utilized than calcium from calcium phosphate and other calcium salts. However, because calcium carbonate contains more calcium per unit weight than other calcium supplements, calcium carbonate is more convenient to use since fewer capsules or tablets are needed to meet recommended intake levels. In addition, all calcium supplements evaluated tended to lengthen fecal transit times in comparison to milk.

Northeast Research and Extension Center

Scientists at the Northeast Research and Extension Center were among those who pioneered use of herbicides to establish warm season grass plantings. They demonstrated that atrazine could be used to establish new plantings of switchgrass and big bluestem. Research is continuing to find herbicides with tolerance to other warm and cool season grass cultivars. Research spanning 15 years continues to develop weed control techniques in various conservation tillage systems. A new phase of this research is looking at various grasses and legumes which might be used as living mulches or underseeded as cover crops for soil erosion protection and weed control.

Soybean production has sometimes been criticized because of the soil erosion potential created by the



This rainfall simulator can dramatically show how soil losses can be reduced by no-till planting.

loose, mellow soil condition following soybeans. However, these soil conditions plus the fragile nature of the residue make no-till planting into soybean residue an excellent option. In research conducted at the Northeast Research and Extension Center using a rainfall simulator, soil losses were reduced by 50 percent or more for no-till planting into soybean residue, compared to soil losses from soybean residue that had been disked twice. Average soil losses were reduced 75 percent by planting on the contour, compared to up-and-down hill planting in soybean residue. By no-till planting on the contour, soil erosion was reduced by nearly 90 percent compared to a double disk system conducted up-and-down the slope in soybean residue. Thus, substantial reductions in soil erosion from soybean production areas are possible.

Research efforts at NEREC are being conducted to determine the effect of facilities (wind protection) on feedlot steer gain. Studies conducted to date have shown that wind protection is beneficial for cattle in the winter; however, detrimental effects of the windbreak are apparent in the summer primarily due to decreased air movement that more than offsets any of the beneficial effects of wind protection observed in the winter.

Implant (growth promotants) systems are another major area of emphasis. Studies to date have shown that subsequent performance of cattle in the feedlot can be depressed if the cattle had received implants previously. Data would suggest that optimum gain and efficiency is achieved when cattle, destined for slaughter, receive all implants post-weaning and preferably when they are being fed high concentrate rations.

Swine housing and energy conservation research has included alternative energy management schemes for 23-day-old weaned pigs housed in flat deck nurseries. By turning the temperature down at night, compared to conventional management of a constant warm temperature, researchers reduced the cost of propane and electricity by 31 percent. In addition, pigs exposed to the diurnal temperature fluctuation ate more feed and grew faster with no difference in feed conversion efficiency.

The application of insecticides through overhead center pivots has rapidly expanded in Nebraska. Experiments at several sites in northeast Nebraska have shown that the technique is successful for control of

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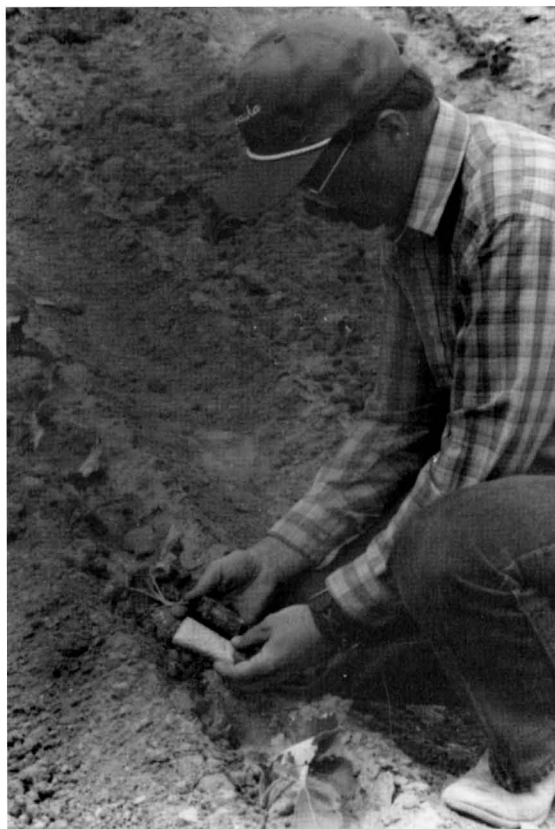
Research Highlights

(Northeast Research and Extension Center....)

first and second generation European corn borers, a serious corn pest. Additional experiments indicate that oil is an unnecessary additive in most instances, the amount of water carrier is unimportant for satisfactory efficacy, reduced rates of selected insecticides are feasible, and that residual is relatively short.

Panhandle Research and Extension Center

Considerable interest has been expressed by local producers and agribusinesses in growing commercial vegetables. To establish a current information base for Nebraska producers, experiments were conducted to examine the yield and quality of selected varieties of broccoli, cabbage, carrots, cauliflower, celery, lettuce, onions, peppers, sweet corn, and tomatoes that were either direct seeded or transplanted. Most crops could be successfully grown in western Nebraska and all crops benefited from transplanting. Crops with the most potential for commercial development were onions, carrots, broccoli, cauliflower, cabbage, sweet corn, and peppers. Data collected provides information on variety selection, plant stand, crop yield, qual-



Transplanting of sugarbeets has proved effective. Now researchers are studying transplanting of other crops, such as broccoli.

ity, and maturity. Although benefits of transplanting varied by crop, transplanted onion yields were 200 percent greater than direct seeded, and these onions were larger in size and matured several weeks earlier than direct seeded onions.

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More than 15 research studies on sugarbeet transplanting have been conducted over the last four years by a multi-disciplinary team at the Panhandle Research and Extension Center. The transplanting system is based on a paperpot container in which growing media and seed are placed. Plants are then germinated and grown in a greenhouse and finally transplanted into the field. Research has been conducted on machinery performance, container design, greenhouse production techniques, field production including weed and nematode control, plant spacing, variety interactions, irrigation requirements, and costs and returns versus direct seeded sugarbeet production.

Compared to direct seeding, advantages of the transplanting system include:

- 1) increased yield which is attributed to lengthening the effective growing season;
- 2) improved weed control and the potential to eliminate hand weeding due to increased competitiveness with weeds and use of different herbicides;
- 3) reduced rates of nematicide application to age of plant when put in the field, placement of chemical in an effective manner, and the paperpot container acting as a barrier; and
- 4) reduced risk of stand loss due to extreme weather and soil crusting.

Additional costs of transplanting include machinery, greenhouses, material, labor, and management. This technology is potentially profitable, but the capacity of machinery and acreage over which costs are spread is very important. This technology has been made commercially available to sugarbeet growers, although further development of equipment and production details is needed.

Plant Pathology

More than 100 strains of bacteria from asymptomatic sorghum and corn stalks are continuing to be analyzed by polypeptide gel electrophoresis. A computer program is being generated for comparing the single dimension gel patterns from densitometer tracings. Preliminary comparisons show both reproducible qualitative and quantitative differences among strains, some of which show both marked similarity or dissimilarity with known pathogens. Some of these bacteria have potentially useful properties.

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A new wilt resistant cucumber that stays sweet while it fights off insects and plant diseases was released jointly by the U.S. Department of Agriculture and University of Nebraska. The new cucumber, "County Fair '83" is ideal for home gardens because it does not become bitter even under severe stress caused by plant disease, drought or inadequate soil nutrients. The natural sweetness of the entire plant is unattractive to cucumber beetles that like to munch on vines having a bitter taste. Cucumber beetles spread the bacteria that cause a wilt disease but the non-bitter characteristic of the plant works, in effect, to ward off the beetles. The cucumber was widely tested in Nebraska before release.



This Opti-Visor device which has an illuminator and magnifier attached, allows the researcher to count spider mites on corn.

South Central Research and Extension Center

A 228-acre reservoir at the Meat Animal Research Center was constructed by the Little Blue Natural Resources District in 1982. The reservoir is for downstream flood protection and for capturing runoff water for groundwater recharge. Research was conducted at the reservoir site: 1) to determine the recharge realized from a new and relatively large multi-purpose surface reservoir, 2) to determine how the rate of recharge changes with age of the reservoir, and, 3) to evaluate the groundwater response to the infiltrated water.

During the first 30 months of monitoring, water infiltration ranged from 0.2 to 2.5 inches per day and averaged 0.65 inches per day. The accumulated vol-

ume of water that has seeped through the bottom of the reservoir was enough to cover 8200 acres with one foot of water. During periods of maximum recharge rates, the water level in the principal aquifer directly below the reservoir rose more than five feet indicating a good response to the recharge water.

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As part of the plant pathology program at the South Central Research and Extension Center, corn hybrids have been evaluated for reactions to three of the more destructive diseases in Nebraska. These include stalk rot, Goss' bacterial wilt and blight, and corn lethal necrosis. Stalk rot evaluations were begun in 1972 and have continued annually.

Publications summarizing the results of the stalk rot, Goss' wilt, and corn lethal necrosis evaluations have been made available to the public. These evaluations have been used extensively throughout the industry (farmers, seed corn companies, corn breeders, and agricultural extension agents) to compare the relative susceptibility of hybrids to these three important diseases. The stalk rot and CLN evaluations are continuing. Crop rotation and hybrid resistance have been very effective in reducing losses caused by corn lethal necrosis and Goss' wilt, although crop rotation has had little effect in reducing stalk rot. The importance of hybrid selection for disease control is obvious.

Textiles, Clothing and Design

Of concern among agriculturalists today is exposure to farm chemicals during mixing and application. Protective clothing can minimize dermal exposure, the most common route of pesticide exposure, but protective clothing becomes contaminated, and contamination is difficult to remove in laundering. Previous research on lowering residues through laundering has involved the study of new textiles. The objective of this study was to determine if "used" fabrics become more easily soiled with pesticides because the "use" had become a predisposer to soiling and had increased the difficulty of pesticide soil removal through laundering. Generally, abrasion did assist in pesticide removal but prior laundering resulted in less complete removal of subsequent pesticide residues. Although prior soiling with pesticides neither increased nor decreased pesticide absorption, build-up was observed.

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Rather than burning or burying protective clothing contaminated with highly toxic pesticides, long-term storage with pesticide degradation due to time or tem-

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Research Highlights

(Textiles, Clothing and Design....)

perature of storage may be feasible. This phase evaluated four conditions of holding (0°, 21°C, ambient 18-24°C but no air exchange, and ambient plus moving air) over six time periods, (24 hours, 48 hours, 72 hours, 1 week, 1 month and 6 months) with methyl parathion-contaminated fabric. There was a steady decrease in pesticide residue over time and moving air greatly assisted the volatilization of pesticides.

The second phase addressed the concern for location and amounts of pesticide residue in 50 percent cotton/50 percent polyester poplin, unfinished, with a durable press finish, or with a soil repellent (fluorocarbon finish), contaminated with methyl parathion. Pesticide solutions were pipetted onto the center of one square meter of fabric, and fabric sampled or laundered (49°C wash and rinse, HDL detergent) then sampled. Pesticide solution did move from the site of the "spill", dependent upon fabric finish. This work confirms previous findings that a soil repellent finish is preferred over unfinished or durable press finished fabric.

The purpose of the third phase was two-fold: 1) to determine build-up of methyl parathion on fabrics contaminated daily for up to five days, and the effectiveness of laundry in lowering pesticide residues from repeated contamination of fabrics and 2) to measure the contamination of water used in the laundering process.

The soil repellent finish caused less absorption of pesticide. In fabrics laundered daily, there was an increase in baseline contamination and the soil repellent finish was effective in lowering sorption of pesticide through two launderings only. A recommendation from this study was to include daily laundering of protective clothing during application seasons.

Veterinary Science

Bovine respiratory syncytial virus (BRSV) is now recognized as a significant respiratory pathogen of cattle. A major problem, however, has been rapid and accurate diagnosis of these infections. Highly specific monoclonal antibodies (moAb) to BRSV have been developed and increase the sensitivity of virus detection tests, while decreasing time and cost of diagnosing infections. The moAb is being used as an effective diagnostic reagent for bovine respiratory disease in many veterinary diagnostic laboratories throughout the United States. Additionally, the moAb is being used in testing procedures for a recombinant vaccine. The vaccine should be more effective, safer, and less expensive than ones presently available to producers and veterinarians.

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Escherichia coli is a bacterium which causes severe diarrheal disease in livestock and humans. Diarrhea-producing strains typically attach to gut cells by means of hair-like projections called pili and induce watery secretion in the bowel lumen by means of toxins. Recently, diarrhea in a group of newborn calves was determined to be caused by an *E. coli* that lacked typical pili and toxins. Experimental studies in germ-free calves established that the organism causes diarrhea, but acts in a manner different from previously recognized calf strains. The organism, in fact, produces a disease remarkably similar to certain strains found in humans, in that bacteria tightly attach to the gut cells resulting in loss of minute surface projections called microvilli. The prevalence of the organism in cattle is unknown, but studies suggest that infections may be missed unless complicated by a concurrent viral infection. Future studies aimed at delineating the mechanism of disease and prevalence of infection should help in the treatment and control of this newly recognized disease of cattle and serve as a model for similar infections in humans.

West Central Research and Extension Center

A corn germplasm was discovered that tolerates high soil pH (surface pH of 8.5 to 9.1, higher in sub soil) while still producing substantial grain yields, in sites where conventional hybrids produced little grain or would not survive. Attempts are underway to transfer this desirable characteristic to corn germplasm better adapted to Nebraska growing conditions.

Soil pH over 8.0 inhibits corn plant growth by disrupting normal use of iron in chlorophyll development. At higher pH levels, most corn germplasm develops little or no chlorophyll and will not survive. The discovery of pH tolerant germplasm could have an impact on up to one million acres in central and western Nebraska and large acreages of high pH soils in the western United States where corn is an important crop. These findings have the potential to increase income stability on land regularly being used for dryland or irrigated crop production.

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The Cropping Systems Research Unit at North Platte is developing technology for limited irrigation combined with no-till methods and crop rotations to conserve water and soil, extend aquifer life, improve environmental quality, and reduce dependence on high levels of irrigation while increasing profits. The no-till

cropping systems being studied under (a) continuous dryland, (b) limited irrigation (6" per crop per year) and (c) full irrigation, include continuous corn, wheat-soybean, wheat-corn-soybean, and wheat-corn-sorghum rotations. The six scientists involved include agronomists, and an ag engineer, economist and hydrologist.

Various cultural practices are evaluated within crop rotations to gain information required for decisions on fertilization, variety selection, plant populations and irrigation timing. Results can be used by both farmers and water management agencies to improve irrigation management, soil and water conservation and net profitability.

Crop yields and irrigation water use efficiency for all crops in continuous no-till systems for limited irri-

gation treatments have exceeded expectations. Preliminary results show how farmers in areas of declining water tables can extend existing water supplies, use moderate resource inputs and achieve economical yields.

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Raw soybeans have been successfully used to replace soybean meal in swine gestation-lactation rations, serving as a favorable protein and energy source. Roasting is essential to secure favorable value of raw soybeans in growing-finishing rations. The swine feeding industry is adopting these findings, allowing producers to utilize lower quality soybeans directly in their feeding programs without the necessity of round trip transportation and more expensive processing.



Corn on the right tolerates high soil pH in sites where conventional hybrids (left) produce little grain or do not survive.

Research Projects



100th

Annual Report

**University of Nebraska
Agricultural Research Division**

Research Projects

Research projects are listed by departments. An asterisk (*) indicates that the project was discontinued in fiscal 1985-1986.

Administration

- 01-001 General administration of federal fund research (I. T. Omtvedt)
- 01-004 Regional research coordination, North Central Region (I. T. Omtvedt)

Agricultural Biochemistry

- *15-005 Harvesting, processing and evaluating alfalfa crops and materials (R. L. Ogden)
- *15-011 Analytical advisory and service laboratory (R. M. Hill)
- 15-022 Cellular photosynthetic processes and the regulation of photosynthesis (R. Chollet)
- *15-028 Biochemistry of plant disease (J. M. Daly)
- 15-030 Factors affecting functional leghemoglobin in legume nodules (R. V. Klucas)
- 15-031 Structure, chemistry and metabolism of compounds toxic to plants (H. W. Knoche)
- *15-032 Mechanisms of cultivar resistance to host-specific fungal pathotoxins (J. M. Daly)
- *15-033 Homogenous pyruvate, pi dikinase from A C₄ plant and photosynthetic bacterium (R. Chollet)
- 15-034 Composition, architecture and functional role of the photosynthetic membrane (J. P. Markwell)
- 15-035 Proteolytic enzymes in plant senescence and molecular studies on metalloproteases (F. W. Wagner)
- 15-036 Factors limiting biological nitrogen fixation: leghemoglobin and nickel (R. V. Klucas)
- 15-037 Soybean nodule senescence (F. W. Wagner)
- *15-038 The role of thylakoid organization in photosynthesis and its regulation (J. P. Markwell)
- 15-039 Associative nitrogen fixation in nonleguminous plants (R. V. Klucas)
- 15-040 Cellular photosynthetic processes and the regulation of photosynthesis (J. P. Markwell)
- 15-041 Genetic manipulation of RuBP carboxylase/oxygenase (R. J. Spreitzer)
- 15-042 Identification of host resistance or susceptibility to toxins (J. M. Daly, H. W. Knoche)
- 15-043 Genetic modification of RuBP carboxylase/oxygenase in chlamydomonas reinhardtii (R. J. Spreitzer)

- 15-044 Regulation of pyruvate, pi dikinase activity (R. Chollet)
- 15-045 Factors affecting fermentation technology of crop materials and by-products (R. L. Ogden)
- 15-046 Investigation of some nitrogeous constituents of selected plants (R. M. Hill)

Agricultural Communications

- 18-001 Dissemination of research information (J. P. Holman)

Agricultural Economics

- 10-071 Effect of changes in transportation on performance of the U.S. Agricultural Transportation System (D. G. Anderson, J. B. Hassler)
- 10-077 Reporting and analyzing farm real estate values and market developments in Nebraska (B. B. Johnson, R. J. Hanson)
- 10-083 Organization and performance of the U.S. Food production and distribution system (L. H. Lutgen, E. Pagoulatos)
- 10-086 Performance of the U.S. grain marketing system in a changing economic and policy environment (D. A. Linsenmeyer, J. B. Hassler)
- 10-087 Evaluating financial markets for agriculture (P. H. Gessaman, G. A. Helmers)
- 10-089 Evaluating risk management strategies for Nebraska farmers (H. D. Jose)
- 10-090 Economic analysis of water management strategies in Nebraska (R. J. Supalla, J. B. Hassler)
- 10-091 An economic analysis of risk management strategies for agricultural production firms (G. A. Helmers, H. D. Jose, J. B. Hassler)
- 10-092 Analysis of food and agricultural policies in an uncertain economic environment (G. A. Helmers, J. G. Kendrick, R. Frederick)
- 10-093 Nebraska water allocation law and policy (J. D. Aiken)
- 10-094 Economics of range beef cattle production systems in Nebraska (G. H. Pfeiffer)
- 10-096 Economic analysis of factors associated with financial success of farmer cooperatives (M. S. Turner)
- 10-097 Economics of uncertain water supplies for irrigation (M. E. Baker, G. A. Helmers)
- 10-098 Evaluation of consumption, production and marketing changes in the crops-livestock sectors (J. F. Yanagida)
- 10-099 Economic analysis of the potential for production and

(continued)

Research Projects

(Agricultural Economics....)

marketing of grain sorghum in the Philippines (D. G. Anderson, G. Pfeiffer)

11-069 Dynamic simulation of soybean/weed competition and effects on crop performance (G. E. Meyer)

Agricultural Education

11-070 Vegetable oils as an alternative fuel for diesel engines (M. A. Hanna)

*24-017 An appraisal of innovative approaches to education/action for rural community resource development (J. T. Horner)

11-071 Mechanics of soil erosion deposition and sediment transport on croplands (J. E. Gilley, L. N. Mielke, J. F. Power)

24-019 Pre-service evaluation of student teachers and of student teaching centers (R. D. Dillon)

11-072 Increasing performance efficiency of agricultural tractors and machinery (L. L. Bashford)

*24-020 An assessment of professionalism and leadership of Nebraska vocational agricultural educators (A. G. Blezek)

11-073 Crop productivity as limited by the rhizosphere and by water and nutrient use efficiencies (D. L. Martin, N. L. Klocke)

Agricultural Engineering

11-074 Modeling responses of growing swine to environmental and nutritional conditions (J. A. DeShazer, A. J. Lewis)

11-001 Evaluation of performance of new tractors (L. I. Leviticus)

11-008 Engineering phases of tillage, land treatment and crop management for conservation of soil and water (H. D. Wittmuss)

11-075 Drying grain to maintain quality and market value (R. O. Pierce)

*11-030 Development and operation of irrigation systems (P. E. Fischbach, A. R. Martin, D. E. Eisenhauer)

11-076 Influences of tillage and crop residue on soil erosion (E. C. Dickey, D. P. Shelton, D. E. Eisenhauer)

*11-033 The dynamics and energetics of the soil-plant-atmosphere continuum (W. E. Splinter, N. J. Rosenberg, G. E. Meyer)

11-077 Irrigation and farmstead electrical demands, load management and safety (L. E. Stetson)

*11-037 Safety, demand, and operational characteristics of electrical irrigation equipment (L. E. Stetson)

Agricultural Research and Development Center

45-001 Field laboratory development (W. W. Sahs)

11-044 Improvement of thermal process for food (M. A. Hanna)

Agronomy

11-053 Adaptive, physiological crop production models with controlled and natural environments (G. E. Meyer)

12-001 Corn breeding and genetics (W. A. Compton, P. T. Nordquist)

11-060 Hybrid solar systems for young pigs (G. R. Bodman, D. D. Schulte, J. A. DeShazer)

12-002 Improvement and evaluation of oats and barley (J. W. Schmidt)

11-061 Development and evaluation of conservation tillage systems (H. D. Wittmuss, E. C. Dickey)

12-007 Systems of weed control in crop production for eastern Nebraska (O. C. Burnside)

*11-062 Integrated energy management for irrigated grain and livestock production (D. D. Schulte, W. E. Splinter)

12-008 Forage grass breeding (K. P. Vogel)

*11-063 Energy and by-products from animal manure (D. D. Schulte)

12-011 Properties of Nebraska soils as related to soil genesis, classification, survey and land use (D. T. Lewis)

11-064 Soybean production and management simulation models (G. E. Meyer)

12-012 Soybean breeding and genetics (J. H. Williams)

11-065 Study rural electric demands and provide electrical load management mechanisms for management of rural power (L. E. Stetson)

*12-023 Optimizing the productive capacity of irrigated soil through effective soil management (R. A. Olson, K. D. Frank)

11-066 Harvesting, processing & utilization of sweet sorghum and oil crops as energy sources for power (L. L. Bashford)

12-034 Cytogenetic studies on wheat (M. R. Morris, J. W. Schmidt, P. J. Mattern, V. A. Johnson)

11-067 Irrigation scheduling methods for efficient water and energy use (J. R. Gilley, D. L. Martin)

12-046 Market quality in wheat (P. J. Mattern, V. A. Johnson, J. W. Schmidt)

12-049 Quantitative genetic investigations in plants (C. O. Gardner, M. Thomas-Compton)

12-055	Genetics, breeding and evaluation of common wheats, durums and triticales for Nebraska (J. W. Schmidt, V. A. Johnson, P. J. Mattern)	*12-113	Mineral element efficiencies and tolerances in sorghum and millet (R. B. Clark, J. W. Maranville, W. M. Ross, R. A. Olson)
12-072	Introduction, multiplication, evaluation, preservation, cataloguing and utilization of plant germplasm (D. Anderson, K. P. Vogel)	12-114	Genetics, biochemistry, and breeding of forage sorghum and sudangrass (F. A. Haskins, H. J. Gorz)
12-076	Evaluation of grain crop variety performance in Nebraska (A. F. Dreier, R. S. Moomaw, R. W. Elmore, P. H. Grabouski, L. A. Nelson, P. T. Nordquist)	*12-115	Breeding sorghum for Nebraska and developing countries (W. M. Ross, D. J. Andrews)
12-077	Systems for controlling weeds with emphasis on velvetleaf, shattercane and leaf spurge (A. R. Martin)	12-116	Crop productivity as limited by the rhizosphere and by water and nutrient use efficiencies (C. Y. Sullivan, D. L. Martin)
12-078	Fate of nutrients in the environment as affected by soil and crop management (D. H. Sander, K. D. Frank)	*12-117	Improvement practices for range on blue grama-buffalograss dominated loess soils in Nebraska (S. S. Waller)
12-080	Chemical aspects of phosphorus movement and availability to plants in sandy soils (R. C. Sorensen)	12-118	Increasing the efficiency of phosphorus fertilizers for winter wheat and corn (D. H. Sander, G. A. Peterson, E. J. Penas, K. D. Frank, F. N. Anderson)
12-084	Evaluating plant nutrient needs and product quality (D. Knudsen)	*12-119	Crop production systems in the western corn belt (S. C. Mason)
12-089	Integrating crop culture, chemicals, and life cycles to control persistent weeds (B. A. Swisher, R. G. Wilson)	12-121	Plant breeding for physiological traits (J. E. Specht, C. O. Gardner, K. P. Vogel, M. D. Clegg)
12-091	Soybean physiology in varietal improvement (J. E. Specht)	*12-122	Grain sorghum and millet response to temperature stress (J. D. Eastin, C. Y. Sullivan)
12-095	Effects of environment and fertilization practices on mineral element uptake, distribution, and use by sorghum (R. B. Clark)	12-123	Characterization of Nebraska rangeland vegetation and its improvement through ecologic and agronomic manipulation (J. L. Stubbendieck, W. W. Stroup)
12-097	Physiological investigations of nutritive value and its improvement in sorghum and millet (J. W. Maranville)	12-125	Modeling the water use and growth of plants (J. M. Norman)
12-100	Nitrogen metabolism and chemical growth regulation of plants (L. A. Klepper)	12-126	Chemistry of micaceous and feldspathic soils in Nebraska (D. L. McCallister)
12-101	Environmental and morphological crop physiology (M. D. Clegg)	12-127	Crop physiological and morphological characteristics and cultural practices affecting crop yield, water use and metabolic efficiency (J. D. Eastin, J. L. Havlin, L. A. Nelson, M. Witt)
12-102	Residue incorporation and soil disturbance effects on crop growth and yield (W. W. Wilhelm)	12-128	Relating soil wetness to selected soil and landscape features and to land use decisions (D. T. Lewis)
12-103	Influence of tillage on soil physical characteristics and biological processes (L. N. Mielke)	12-129	Physical factors controlling microbiological aspects of movement and transformation of solutes in soil (J. M. Skopp)
12-109	Improving nitrogen-use efficiency in conservation production systems (J. F. Power, L. N. Mielke, W. W. Wilhelm)	*12-130	Gene locations for wheat economic traits by reciprocal chromosome substitutions (M. R. Morris)
12-110	Dynamics of water in rigid and swelling soils (D. Swartzendruber)	12-131	Dissipation and bioavailability of herbicides and other pesticides in soil (P. J. Shea)
*12-111	Morphology and physiology of selected perennial grasses (L. E. Moser)	12-132	Improving the forage quality of grasses (B. C. Gabrielsen, R. A. Britton, K. P. Vogel)
*12-112	Organic residues and by-products in crop production (W. W. Sahs)	12-133	Ontogenetic and physiological factors in the root bud development of three geophytes (B. A. Swisher)

(continued)

Research Projects

(Agronomy....)

- 12-134 Revegetation for increased productivity of abandoned irrigated and dry farm land (J. Stubbendieck, S. S. Waller, J. R. Gilley)
- 12-135 Soil productivity and erosion (D. T. Lewis)
- *12-136 Mechanics of soil erosion, deposition and sediment transport on croplands (J. E. Gilley, L. N. Mielke, J. F. Power)
- 12-137 Methods to improve production of grazing livestock (B. E. Anderson)
- 12-139 Improved management practices for conservation and utilization of nitrogen (J. S. Schepers, J. F. Powers)
- 12-140 Fertilizer and crop management techniques for conservation-production systems (G. E. Varvel)
- 12-141 Mineral element uptake, use, efficiency, and tolerance in sorghum and millet (R. B. Clark, J. W. Maranville, D. Andrews, M. D. Clegg)
- 12-142 Influence of production practices on yield and grain quality of maize and winter wheat (S. C. Mason)
- 12-143 Genetic, physiological, and chemical studies of traits determining nutritional value and agronomic performance in wheat (S. L. Kuhr, C. J. Peterson)
- 12-144 Winter wheat germplasm development and evaluation (C. J. Peterson, S. L. Kuhr)
- 12-145 Physical/chemical basis for microbial activity and nutrient cycling with conservation management (J. W. Doran, S. R. Lowry, J. F. Power, L. N. Mielke, W. W. Wilhelm, J. M. Skopp)
- 12-146 Gene expression and senescence in the soybean leaf (P. Staswick)
- 12-147 Microbial and nutrient factors affecting crop rotations (M. D. Jawson)
- 12-148 Morphology and physiology of selected perennial grasses (L. E. Moser)
- 12-149 Breeding sorghum and pearl millet for USA and developing countries (D. J. Andrews)
- 12-150 Water and temperature effects on sorghum and millet as related to grain production and breeding (J. D. Eastin, C. Y. Sullivan)
- 12-151 Tillage influence on crop production and physical properties of the soil surface and rhizosphere (A. J. Jones, L. N. Mielke, J. M. Norman)
- 12-152 Renovation and improvement of Nebraska range and pasture (S. Waller)
- 12-201 Maintenance, increase and distribution of elite germ plasm (R. N. Mills)
- 47-001 Soil fertility investigations related to corn, sorghum,

wheat and soybeans grown in southeast Nebraska (E. J. Penas)

Animal Science

- 13-022 Mineral requirements of swine (E. R. Peo, Jr., A. J. Lewis)
- *13-023 Meat manufacturing, restructuring and processing (R. W. Mandigo, C. R. Calkins)
- 13-029 Genetic improvement of efficiency in the production of quality pork (R. K. Johnson, D. R. Zimmerman, R. J. Kittok)
- 13-036 Improving dairy herd management practices (L. L. Larson, F. G. Owen)
- 13-041R Improving dairy cattle through breeding, with special emphasis on selection (F. E. Eldridge)
- 13-045 Improvement of beef cattle through breeding methods (M. K. Nielsen)
- 13-050 Factors affecting texture of fresh and processed meat products (C. R. Calkins, R. W. Mandigo)
- 13-052 The requirements for and utilization of protein and amino acids by swine (A. J. Lewis, E. R. Peo, Jr.)
- 13-055 A systems approach to the evaluation of environmental constraints affecting poultry production (M. M. Beck)
- 13-056 Nutrient levels and sources for layers and turkeys (T. W. Sullivan)
- 13-058 Physiological mechanisms and reproductive management of the postpartum interval and puberty in the bovine female (J. E. Kinder, R. J. Kittok, G. H. Deutscher)
- 13-060 Physiological and management aspects of puberty and ovulation rate in swine (D. R. Zimmerman, R. J. Kittok)
- 13-061 Energy metabolism in avian brain (M. M. Beck)
- 13-062 Beef production systems based on optimum use of crop residues and forages (T. J. Klopfenstein, J. K. Ward, D. R. Brink, R. A. Britton, P. Q. Guyer, R. A. Stock)
- 13-063 Reproductive endocrinology of the bovine in the nutritionally induced state of anestrus (J. E. Kinder, R. J. Kittok, E. T. Clemens)
- 13-064 Pork carcass evaluation (W. T. Ahlschwede, R. K. Johnson, R. W. Mandigo)
- 13-065 Factors affecting acidosis in ruminants (R. A. Britton, D. R. Brink, T. J. Klopfenstein, R. A. Stock)
- 13-066 Dynamics of forage production and utilization by beef cattle (T. J. Klopfenstein, J. Stubbendieck, K.

- VonBargen, T. L. Thompson, G. A. Helmers)
- 13-067 Redirecting the nutrient flow in cows for maximum milk production (F. G. Owen, L. L. Larson)
- 13-068 Integration of comfort parameters with feed intake and other physiological and productivity responses in poultry (E. W. Gleaves)
- 13-070 Control of gonadotropin secretion in boars (R. J. Kittok, R. K. Johnson, J. E. Kinder)
- 13-071 Evaluating the utilization of grain diets fed to finishing cattle (R. A. Stock, R. A. Britton, T. J. Klopfenstein, T. L. Mader)
- 13-072 Forage utilization and ammoniation of crop residues for beef cows (J. K. Ward)
- 13-073 Improving utilization of ensiled forage by sheep (D. R. Brink)
- 13-074 Physiological and nutritional aspects of the postpartum interval to conception in dairy cattle (L. L. Larson, F. G. Owen)
- 13-075 Factors affecting rumen lactate production and effects of acidosis on nutrient metabolism and absorption (R. A. Britton)
- 13-076 Regulation of energy metabolism in the brain of the domestic fowl (M. M. Beck)
- 13-077 Selection effectiveness for reproduction and energy utilization in mice (M. K. Nielsen)
- 13-078 Estimation of breeding values of reproductive and other performance traits in swine (R. K. Johnson)
- 13-079 Evaluation of management practices and traits that influence reproductive efficiency in beef cattle (J. E. Kinder, M. K. Nielsen, W. A. Zollinger)
- 13-080 Factors regulating protein turnover and growth in skeletal muscle (S. J. Jones, C. R. Calkins, R. A. Britton, J. E. Kinder, M. G. Zeece)
- 13-081 Effect of energy source and feed additives on energy utilization by swine (E. R. Peo, Jr., A. J. Lewis)
- 13-082 Optimum use of rangeland, pasture and crop residues in beef production system (T. J. Klopfenstein)
- 13-083 Improving the profitability of dairy cattle production by use of DHIA records (J. F. Keown)
- 13-084 Meat manufacturing, restructuring and processing (R. W. Mandigo, C. R. Calkins)

Biometrics and Information Systems Center

- 23-001 Applications of statistics to research in agriculture (W. M. Schutz, R. F. Mumm, A. M. Parkhurst, S. R. Lowry, W. W. Stroup)

- 23-002 Statistical computing methodology for research planning and analysis (W. W. Stroup)

Center for Agricultural Meteorology and Climatology

- *27-001 Climate variability, drought and agricultural productivity in Nebraska (D. A. Wilhite, R. E. Neild)
- 27-002 Chemistry of atmospheric deposition — effects on agriculture, forestry, surface waters and materials (S. B. Verma)
- 27-003 Carbon dioxide exchange and crop water use efficiency: impacts of microclimate and turbulence (S. B. Verma, N. J. Rosenberg)
- 27-004 Spectral radiation techniques to estimate productivity and water stress in vegetation (B. L. Blad)
- 27-005 A climate data base and model for estimating crop yields (K. G. Hubbard)
- 27-006 Environmental and genotypic control of assimilate allocation in crops (N. J. Rosenberg, M. D. Clegg, J. D. Eastin, J. W. Maranville, G. E. Meyer, J. M. Norman, S. B. Verma, F. W. Wagner)

Consumer Science and Education

- 92-011 Relationship of perceptions of solar and earth sheltered systems to behavior of housing intermediaries (E. R. Combs)
- 92-012 Residential mobility of rural populations and relocation of the rural elderly (J. A. Memken)
- 92-013 Economic, social, psychological and health consequences of the housing decisions of rural families (E. R. Combs, J. A. Memken)

Entomology

- *17-025 Phenology and genetics as ecological bases for the management of the european corn borer (J. F. Witkowski)
- 17-030 Pest management strategies for leafhoppers, spittlebugs, and aphids on alfalfa (G. R. Manglitz)
- 17-032 Biology and integrated control of the greenbug and other arthropods on grain sorghum (S. D. Kindler)
- 17-033 Ecology and control of stable flies and horse flies around confined livestock (I. L. Berry, J. J. Petersen, G. D. Thomas, C. B. Gilbertson)
- 17-034 Insects affecting tree and shrub plantings in Nebraska (J. A. Jones)
- *17-036 Biology and control of corn rootworms in Nebraska (Z B Mayo, H. J. Ball)
- 17-037 Population ecology and management of western bean cutworms and spider mites on corn in western Nebraska (T. O. Holtzer)

(continued)

Research Projects

(Entomology....)

- 17-038 Integrated pest management of insects associated with the near environment of man (R. E. Gold)
- 17-039 Factors affecting the population ecology of a rangeland grasshopper, *Phoetaliotes nebrascensis* (Thomas) (A. Joern)
- 17-040 Aquatic invertebrates as indicators of water quality in Nebraska streams (K. P. Pruess)
- 17-041 Improvement of legume and grass insect control (G. R. Manglitz)
- 17-042 Cytogenetic factors associated with the development of aphid biotypes with specific emphasis on the greenbug, *Schizaphis graminum* (rondani) (Z B Mayo)

Environmental Programs

- 25-001 Continuing participation in the national agricultural pesticide impact assessment program (R. E. Gold, S. T. Kamble)

Food Science and Technology

- 16-027 Food quality and energy usage in food service systems microwave and convection thermal processing (R. B. Maxcy)
- 16-033 Marketing and delivery of quality cereals and oilseeds in domestic foreign markets (L. B. Bullerman, A. P. Handel)
- *16-034 Heat stable enzymes from thermophilic microorganisms (J. H. Rupnow)
- 16-036 Utilization of Nebraska grown grains for human and industrial uses (C. E. Walker)
- *16-037 Proteins: Alteration during processing and the products formed during digestion (L. D. Satterlee)
- *16-038 Optimization of corn and whey cofermentation (K. M. Shahani, C. E. Walker)
- 16-039 Irradiation of meats for improving the microbial quality (R. B. Maxcy)
- 16-040 Analytical methods for food process control and measurement of processing induced changes (R. L. Wehling)
- 16-041 Factors affecting protein functional and nutritional properties (M. G. Zeece)
- 16-042 Molds and mycotoxins in foods and feeds (L. B. Bullerman)
- 16-043 Occurrence, detection, and control of pathogenic bacteria in foods (M. B. Liewen)
- 16-044 Role of cathepsins H and L in muscle protein degradation (M. G. Zeece)
- 16-045 Enzymatic modification and bioprocessing of food and food wastes (K. M. Shahani)

- 16-046 Studies on naturally occurring substances that affect the nutritional quality of new food plants (J. H. Rupnow)
- 16-047 The isolation and development of antioxidants from plant sources (S. L. Cuppett)
- 22-021 Function, nutritive composition quality, stability and efficient production of poultry products (G. W. Froning, R. Dam)

Forestry, Fisheries and Wildlife

- 20-023 Windbreak shelter effects (J. R. Brandle)
- 20-028 Forest tree improvement — selection, breeding, and seed production (D. F. VanHaverbeke)
- 20-041 Vegetation selection and prescribed burning for fire prevention along railroad rights-of-way (J. R. Brandle)
- 26-001 Impact of erosion silt and sedimentation on fish populations (E. J. Peters)
- *26-002 Interfacing of wildlife resources and agriculture (R. M. Case)
- 26-003 Biology and control of the Zimmerman pine moth and other insect pests of forests in Nebraska (M. O. Harrell)
- 26-004 Management and biology of birds and rodents in agricultural systems (R. J. Johnson)
- 26-005 The gypsy moth and its natural enemies: behavior and population determinants (M. O. Harrell)
- 26-006 Interactions of wildlife and agricultural systems in Nebraska (R. M. Case, R. M. Timm, J. R. Brandle)

Horticulture

- 20-036 Genetics, breeding and cultural interactions of dry edible beans (*Phaseolus vulgaris* L.) (D. P. Coyne, J. R. Steadman, A. K. Vidaver, D. S. Nuland)
- *20-037 Assessment of impact of climate on agriculture in Nebraska and the North Central Region (R. E. Neild, D. A. Wilhite)
- 20-037R Weather and climate research for agricultural decision making in the North Central Region (R. E. Neild)
- 20-039 Improvement, propagation and culture of selected Nebraska wildflowers (S. S. Salac, J. B. Fitzgerald)
- 20-040 Genetic improvement of beans (*phaseolus vulgaris* L.) for yield, pest resistance and nutritional value (D. P. Coyne, M. L. Schuster, J. R. Steadman)
- 20-044 Breeding turfgrasses for the Central Great Plains (T. P. Riordan)
- 20-045 Cold hardiness evaluation, selection, propagation and

production of woody plants for Nebraska (W. A. Gustafson, Jr.)

20-046 Growth and development of ornamental plants as influenced by nutritional factors (E. T. Paparozzi)

20-047 Turfgrass ET rates, canopy resistance, and drought avoidance mechanisms (R. C. Shearman, E. J. Kinbacher)

Human Development and the Family

93-015 Independent living rehabilitation/habilitation for persons with severe disabilities (L. O. Schwab)

93-016 Stress, coping and adaptation in the middle years of the family life cycle (J. D. DeFrain)

93-017 Cognitive development and cognitive style within cross cultural perspective (V. Kalyan-Masih)

93-018 Farm wives external employment, family economic productivity and family functioning (P. Knaub)

93-019 Strengths and stresses of rural and urban Nebraska families (J. D. DeFrain, N. Stinnett)

93-020 Rural families and loneliness-incidence, extent, factorial relationship and coping strengths (J. C. Woodward)

93-021 Work and the family: perceptions of rural families and families of remarriage (P. Knaub)

93-022 Familial and environmental support for persons with severe disabilities in non-metropolitan areas of the midwest (L. Schwab)

Human Nutrition and Food Service Management

91-020 Nutrient bioavailability — a key to human nutrition (C. V. Kies, H. M. Fox)

91-025 Modification of human diets designed to affect lipid metabolism (C. V. Kies)

91-026 Communication strategies to improve nutritional practices of adolescents (H. M. Fox)

91-027 Nutrition problems of the elderly in southeast Nebraska and methods of changing food behavior (N. M. Betts, H. M. Fox)

91-028 Changes in dietary intake produced by social environment (H. M. Fox, N. M. Betts)

91-029 Palatability, acceptability and safety of food products and techniques used to prepare and preserve (P. Staats, A. Brenner)

91-030 Development of educational models focusing on the changing management skills needed by practicing dietitians (A. L. Hay, A. M. Brenner)

91-031 Utilization of nutrients in humans as influenced by current and projected dietary practices (C. V. Kies)

Northeast Research and Extension Center

42-003 Biology and control of the european corn borer and other selected insects of agronomic crops (J. F. Witkowski)

*42-004 Management practices for renovation and/or improvement of pastures in northeast and eastern Nebraska (R. S. Moomaw, B. E. Anderson, C. A. Shapiro)

42-005 Influence of certain management regimens on performance of newly purchased feeder pigs (M. C. Brumm, E. R. Peo, Jr.)

42-006 Influence of housing and management regimes on nursery energy utilization and performance of early weaned pigs (M. C. Brumm, D. P. Shelton)

42-007 Beef production alternatives for the farmer-feeder (T. L. Mader, R. A. Britton, H. D. Jose)

*42-008 Irrigation management of sloping loess soils (T. W. Dorn)

42-009 Impact of integrated crop management practices on European corn borer and related stalk boring insects (J. F. Witkowski)

Panhandle Research and Extension Center

*20-010 Improvement of potatoes as a food and energy resource (R. B. O'Keefe)

20-034 Quality and nutritive value of processed potatoes (R. B. O'Keefe)

44-004 Fertilizer and manure application for production of continuous corn (F. N. Anderson)

44-005 Testing hybrids and varieties of small grains, corn, sorghum, and other crops as needed for adaptation to western Nebraska (L. A. Nelson)

44-011 Development of dryland cropping systems for western Nebraska (J. L. Havlin)

44-012 Improvement of millet, corn and sorghum production by breeding and cultural studies (L. A. Nelson)

44-016 Weed control for western Nebraska irrigated crops and rangelands (R. G. Wilson, Jr.)

44-020 Efficient use of limited water supplies (C. D. Yonts, J. A. Smith, D. S. Nuland, L. A. Nelson)

*44-023 Supplementation and utilization of forage and grain resources in the High Plains Region (I. G. Rush, T. J. Klopfenstein)

44-024 Bionomics and management of selected insect pests in the Nebraska Panhandle (A. F. Hagen)

44-025 Biology and control of nematodal and fungal plant diseases in the Nebraska Panhandle (E. D. Kerr)

(continued)

Research Projects

(Panhandle Research and Extension Center....)

- 44-026 Vegetation and animal response to a nonselective grazing system on native range in western Nebraska (P. E. Reece)
- 44-027 Cultural and nutrient investigations for crops of western Nebraska (F. N. Anderson)
- 44-028 Reduction of corn losses caused by nematodes in the North Central Region (E. D. Kerr, D. S. Wysong)
- 44-029 Machinery requirements and water management of conservation tillage for irrigated row crops in the Nebraska Panhandle (J. A. Smith, C. D. Yonts)
- 44-030 The effect of microclimate on plant pests in a semiarid environment (A. Weiss)
- 44-031 Transplanting sugarbeets and other vegetable crops (J. A. Smith, C. D. Yonts, R. G. Wilson, E. D. Kerr, J. G. Robb)

Plant Pathology

- 21-001 Plant disease survey and special investigations (M. G. Boosalis, D. S. Wysong, J. E. Watkins)
- 21-003 Detection and control of virus diseases in Nebraska (L. C. Lane)
- 21-005 Control of cephalosporium stripe of wheat, *rhizoctonia solani* of sugar beets and soilborne diseases (M. G. Boosalis, J. E. Watkins, B. L. Doupnik, G. A. Wicks, D. H. Yocom, E. D. Kerr)
- 21-006 Determine etiology of stem diseases of cottonwood, honeylocust, and pines (M. G. Boosalis, G. W. Peterson, J. W. Riffle)
- 21-010 Plant pathology outstate testing (M. G. Boosalis, D. S. Wysong, J. E. Watkins)
- 21-012 Electron microscopy in agricultural research (W. G. Langenberg, M. K. Brakke, E. M. Ball)
- 21-015 Epidemiology of diseases of bean and other vegetables in Nebraska (J. R. Steadman)
- 21-021 Characterization and genetics of bacterial plant pathogens and related bacteria (A. K. Vidaver)
- 21-022 Biological control of soil-borne plant pathogens in integrated crop management systems (M. G. Boosalis, G. Wicks, D. H. Yocom)
- 21-023 Detection, survival, and control of plant pathogenic bacteria on seeds and other plant parts (A. K. Vidaver)
- *21-030 Evaluation of grain sorghum protoplasts as tools for disease resistance against specific toxins (J. E. Partridge)
- 21-032 Genetics of stalk rot disease complex in corn and sorghum (G. S. Sidhu)

- 21-033 Identification of genes controlling reaction of sorghum to MDMV (S. G. Jensen)
- 21-034 Genetics and genome of a eukaryotic algal virus (J. L. VanEtten)
- 21-035 *Corynebacterium* pathogens of corn and wheat: serology and genetics (A. K. Vidaver)
- 21-036 Host-parasite interactions between fungal pathogens and their hosts (J. E. Partridge)
- 21-037 Fungicide management strategies for control of rusts, leaf spots, and blights of grass hosts (J. E. Watkins)

Roman L. Hruska U.S. Meat Animal Research Center

- 46-001 Development and operation of the U.S. Meat Animal Research Center (R. R. Oltjen)
- 46-002 Improvement of beef cattle through breeding methods (R. M. Koch, L. V. Cundiff, K. E. Gregory)
- 46-004 Improvement of beef cattle through breeding methods (germ plasm evaluation) (L. V. Cundiff, R. M. Koch)
- 46-007 Improvement of beef cattle through breeding methods (K. E. Gregory, L. V. Cundiff, R. M. Koch)
- *46-008 Limiting stress of food producing animals to increase efficiency (G. L. Hahn, J. A. Nienaber)
- 46-009 Genetic improvement of efficiency in the production of quality pork (L. D. Young, G. E. Dickerson, K. A. Leymaster, R. M. Koch)
- 46-010 Increased efficiency of lamb production (K. A. Leymaster, L. D. Young, G. E. Dickerson, R. M. Koch)

South Central Research and Extension Center

- 48-003 Field crop arthropod distribution and control in South Central Nebraska (L. L. Peters)
- 48-004 Occurrence of mycotoxins in feeds and foods and their effects on animal and human health (B. L. Doupnik, N. R. Schneider)
- 48-005 Biology and control of troublesome weeds in South Central Nebraska (F. W. Roeth)
- *48-006 Management of water and energy on irrigated farms in South Central Nebraska (D. E. Eisenhauer)
- 48-009 Soybean cultural practices and cropping systems for South Central Nebraska (R. W. Elmore)
- 48-010 Neuroendocrine and environmental influences on sexual behavior in male pigs (D. G. Levis, J. J. Ford, R. K. Christenson)
- 48-011 Water conservation practices for irrigated agriculture in South Central Nebraska (D. E. Eisenhauer)

Textiles, Clothing and Design

- 94-011 Effects of functional textile finishes on comfort and protection of consumers (J. M. Laughlin)
- 94-012 Limiting pesticide exposure through textile cleaning procedures and selection (J. M. Laughlin, R. E. Gold)
- 94-013 The study of clothing as a contributor to the self-esteem of individuals with special needs (R. Kean, A. Newton)

Veterinary Science

- 14-001 Diagnostic surveillance of livestock and poultry health problems in Nebraska (E. D. Erickson, A. R. Doster, C. L. Kelling, N. R. Schneider)
- 14-009 Prevention and control of enteric diseases of swine (R. Moxley, E. O. Dickinson)
- 14-014 Bovine respiratory disease (M. L. Frey, M. B. Rhodes, E. O. Dickinson)
- 14-018 Integrated methods of parasite control for improved livestock production (M. B. Rhodes, D. L. Ferguson, E. O. Dickinson)
- *14-019 Respiratory diseases of swine (M. B. Rhodes, C. L. Kelling, E. O. Dickinson, E. D. Erickson)
- *14-020 Infectious diseases of young calves (M. L. Frey, E. O. Dickinson)
- *14-024 Mycotoxicoses of swine in Nebraska (N. R. Schneider, A. Hogg, B. L. Doupnik, E. R. Peo, Jr., S. R. Lowry)
- 14-025 Bovine respiratory syncytial virus: pathogenesis and immune response (M. L. Frey, G. A. Anderson)
- *14-027 Pathophysiology of the porcine stress syndrome: hormonal response to stress (E. T. Clemens, R. W. Mandigo)
- 14-028 Bovine viral diarrhea virus and reproduction in cattle (C. L. Kelling, M. L. Frye, A. R. Doster, M. B. Rhodes, S. R. Lowry)
- 14-029 Antigens of *Ascaris suum* which stimulate antibody production in swine (M. B. Rhodes)
- 14-030 Perinatal immune responses during infectious diseases in the bovine (G. A. Anderson)
- *14-031 Genetic resistance of pigs and cattle to infectious diseases with special consideration of lysozyme (E. O. Dickinson)
- 14-032 Monoclonal antibodies for characterization of bovine respiratory syncytial virus infections (G. A. Anderson)
- 14-033 Nutritional impact on colonic structure and function (E. T. Clemens)
- 14-034 Immunoperoxidase and monoclonal antibodies: diagnosis of bluetongue virus-induced fetal disease (G. A. Anderson)

- 14-035 Detection of viruses in bovine semen by nucleic acid hybridization (F. A. Osorio)
- 14-036 Immunity to infectious bovine rhinotracheitis (S. Srikumaran)
- 14-038 Lymphokine regulation of antibody production in bovine respiratory infections (S. Srikumaran)
- 14-039 Nebraska SPF swine laboratory (J. A. Schmitz, G. A. Anderson, A. Hogg, T. E. Socha)
- 14-040 Occurrence of mycotoxins in feed and foods and their effects on animal and human health (N. R. Schneider)
- 14-041 Development of rapid diagnostic techniques for virus diseases of livestock (F. A. Osorio)

West Central Research and Extension Center

- 43-007 Sorghum breeding and cultural research under reduced tillage (P. T. Nordquist)
- 43-020 Animal disease surveillance in western Nebraska (J. L. Johnson)
- 43-024 Biology, ecology and control of major insects affecting livestock (primarily bovine) in Nebraska (J. B. Campbell)
- 43-028 Development and culture of herbaceous ornamental plants (D. T. Lindgren)
- 43-031 Optimization of the use of range and complementary forages for red meat production (D. C. Clanton, J. T. Nichols)
- *43-032 Utilization of high fiber feedstuffs in pork production (D. M. Danielson)
- 43-033 Bionomics, vector capabilities and management strategies for face flies (J. B. Campbell)
- 43-034 Weed control in reduced tillage systems in West Central Nebraska (G. A. Wicks)
- 43-035 Evaluation of management practices to improve reproductive efficiency of beef cattle (G. H. Deutscher, D. C. Clanton)
- *43-036 Analysis of production systems and IPM research needs in the North Central Region (J. B. Campbell)
- 43-037 Characteristics and feed value of barley and western protein supplements for swine (D. M. Danielson)
- 43-038 Nutrition and management of cattle on range and in the feedlot (D. C. Clanton, G. H. Deutscher, I. G. Rush, C. R. Calkins)
- 43-039 Soil evaporation and plant transpiration from irrigated row crops (N. L. Klocke)
- 43-040 Increasing fertilizer nitrogen use efficiency in West Central Nebraska (G. W. Hergert)
- 43-041 Methods of processing differing sources and combinations of fiber and energy for swine (D. M. Danielson)

Publications



100th

Annual Report

**University of Nebraska
Agricultural Research Division**

Publications

Agricultural Biochemistry

Journal Articles

- Baker, N. R. and J. P. Markwell.
Pigment-protein complexes and their interactions. In *Topics in Photosynthesis*. Vol. 6. Photosynthetic Mechanisms and the Environment (J. Barber, ed.) Elsevier, Amsterdam, p. 49-90. 1985.
- Budde, R. J. A., G. P. Holbrook, and R. Chollet.
Studies on the dark/light regulation of maize leaf pyruvate, orthophosphate dikinase by reversible phosphorylation. *Arch. Biochem. Biophys.* 242:283-290. 1985.
- Danko, S. J. and J. P. Markwell.
Protein phosphorylation in plant mitochondria. *Plant Physiol.* 79:311-314. 1985.
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Reduced apparent photorespiration by the C₃-C₄ intermediate species, *Moricandia arvensis* and *Panicum milioides*. *Plant Physiol.* 77:578-583. 1985.
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- Jordan, D. B., and R. Chollet.
Subunit dissociation and reconstitution of ribulose-1,5-bisphosphate carboxylase from *Chromatium vinosum*. *Arch. Biochem. Biophys.* 236:487-496. 1985.
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Structure of an amino acid analog of the host-specific toxin from *Helminthosporium carbonum*. *Tetrahedron Letters* 26: 969-972. 1985.
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Studies on the host-specific pathotoxins produced by *H. maydis*, race T and *P. maydis*: absolute configuration of PM-toxins and HMT-toxins. *Agric. Biol. Chem.* 49: 559-562. 1985.
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Effects of P-455_{acc} inhibitors on corticosterone production by rat adrenal cells. *J. Biol. Chem.* 260: 852-859. 1985.
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Fluorescence emission spectra and thylakoid protein kinase activities of three higher plant mutants deficient in chlorophyll b. *Biochim. Biophys. Acta* 808:156-163. 1985.
- Markwell, J. P., A. N. Webber and B. Lake.
Mutants of sweetclover (*Melilotus alba*) lacking chlorophyll b: Studies on pigment-protein complexes and thylakoid protein phosphorylation. *Plant Physiol.* 77:948-951. 1985.
- Ogren, W. L., M. H. Spalding and R. J. Spreitzer.
Analysis of *Chlamydomonas reinhardtii* mutants with defects in the CO₂ concentrating system. In *Nitrogen Fixation and CO₂ Metabolism*, eds. P. W. Ludden and J. E. Burris. Elsevier/North-Holland, New York, pp. 351-357. 1985.
- Prescott, J. M., F. W. Wagner and B. Holmquist.
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- Zaarawi, W. K.
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- Zachariassen, J. A.
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- Goldberg, K. B.
Concentrations of Maize Chlorotic Mottle Virus and Maize Dwarf Mosaic Virus in Single and Mixed Infections. (M. K. Brakke, Advisor)
- Fujimoto, D. K.
Analysis of Strain Variation in *Xanthomonas Campestris* Pathovar (*Phaseoli* (Smith) Dye. (A. K. Vidaver, Advisor)

Ph.D. Thesis

- Xia, Y.
Studies of a Restriction and Modification System Induced by PBCV-1 Virus Infection of a Chlorella-like Green Alga. (J. L. Van Etten, Advisor)

South Central Research and Extension Center

Journal Articles

- Watkins, J., B. Doupnik, and L. Coziar.
Effect of fungicide treatment and timing of application on foliar disease development in winter wheat. *Fungicide-Nematicide Tests* 40:145-146. 1985.

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Retail Store Buyers. *Clothing and Textiles Research Journal.* 4(1):31-37. 1985.

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Brown, T. L.

Virus Concentration Procedures for Assay of Run-Off Water from Farms with Pseudorabies Infected Swine. (C. L. Kelling and M. L. Frey, Advisors)

Jewett, C. J.

Characterization of Selected Bovine Viral Diarrhea Virus Isolates in Gnotobiotic Lambs (C. L. Kelling and M. L. Frey, Advisors)

Lin, B. C.

Detection of *Mycoplasma Hyopneumoniae* in Formalin-Fixed, Paraffin-Embedded Porcine Lung by Use of the Immunoperoxidase Method, and a Failure to Induce Pulmonary Lesions in Rats Inoculated with *Mycoplasma Hyopneumoniae* (A. R. Doster, Advisor)

Schultz, B. D.

Effect of Epinephrine and/or Pentagastrin on Canine Secretion and Blood Chemistry. (E. T. Clemens, Advisor)

Ph.D. Thesis

Nichelson, R. L.

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West Central Research and Extension Center

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Wicks, G. A.

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Whittier, J. C.

Effect of Varying Time of Nutrient Intake During Two Production Stages on Productivity of Two-year Old Beef Heifers. (D. Clanton and G. Deutscher, Advisors)

Worrell, M. A.

Effect of Meadow Hay Quality on Voluntary Intake, Rate of Passage and Rate of Structural Degradation in Growing Cattle. (D. Clanton, Advisor)

AGRICULTURAL RESEARCH SITES

Panhandle Research and
Extension Center, Scottsbluff

Northwest Agricultural
Laboratory, Alliance

Gudmunsen Sandhills Laboratory

Northeast Research and
Extension Center, Concord

Genoa Farm (Foundation Seed), Genoa

Agricultural Research
and Development Center, Mead

Horning
State Farm (Forestry),
Plattsmouth

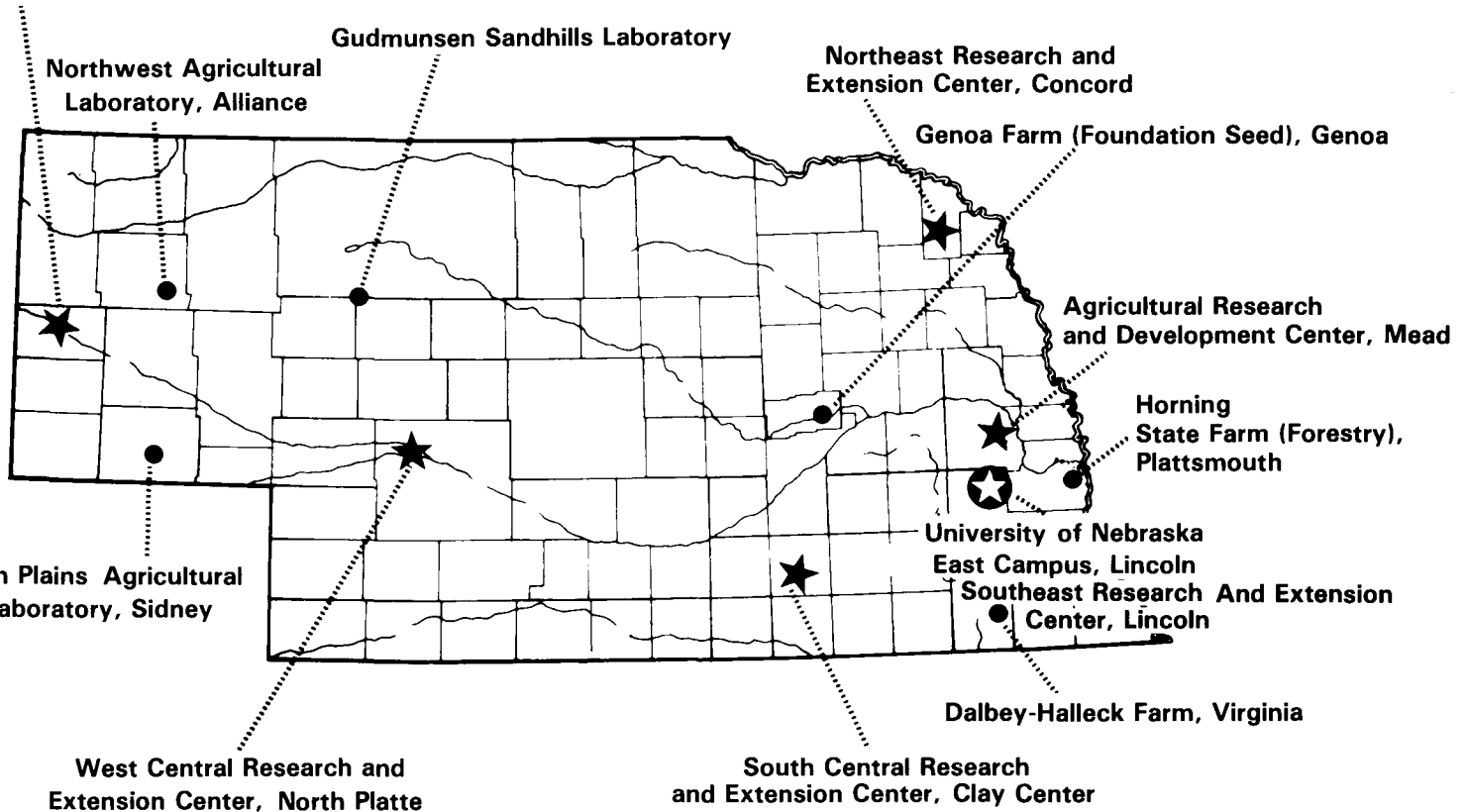
University of Nebraska
East Campus, Lincoln
Southeast Research And Extension
Center, Lincoln

Dalbey-Halleck Farm, Virginia

South Central Research
and Extension Center, Clay Center

High Plains Agricultural
Laboratory, Sidney

West Central Research and
Extension Center, North Platte



Budget



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Annual Report

**University of Nebraska
Agricultural Research Division**

**REPORT OF RESEARCH EXPENDITURES
THE UNIVERSITY OF NEBRASKA
AGRICULTURAL EXPERIMENT STATION
(July 1, 1985 through June 30, 1986)**

FEDERAL FORMULA FUNDS:

Hatch Formula	\$2,018,807
Regional Research	744,000
McIntire-Stennis	102,212
Animal Health	170,282
Total Federal Formula Funds	\$3,035,301

STATE APPROPRIATED FUNDS\$12,610,563

CONTRACTS AND GRANTS:

USDA Coop Agreements	\$2,509,390
USDA Special & Competitive	446,307
Federal Grants - NSF, NIH, HEW, AID	1,740,861
Industry Grants	2,180,724
Total Contracts and Grants	\$6,877,282

Sub-Total\$22,523,146

PRODUCT SALES:\$4,418,118

TOTAL EXPENDITURES:.....\$26,941,264