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85th Annual Report of the Nebraska Agricultural Experiment Station. July 1, 1970 to June 30, 1971

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85TH **ANNUAL REPORT**

OF THE
NEBRASKA
AGRICULTURAL
EXPERIMENT
STATION

July 1, 1970
to
June 30, 1971

University of Nebraska College of Agriculture
The Agricultural Experiment Station
E. F. Frolik, Dean; R. W. Kleis, Act. Dir.

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Issued January 1972, 1500

FOREWORD

The 85th Annual Report of the Nebraska Agricultural Experiment Station contains a list of all active projects during July 1, 1970 to June 30, 1971, a list of Station publications, staff members, and a financial report. Information derived from the various research projects is published in bulletins, circulars, scientific and trade journals, in the *Nebraska Farm, Ranch and Home Quarterly* and as mimeographed departmental reports. Station bulletins, circulars and the *Quarterly* may be obtained free from any county agricultural agent or by writing to the Director of the Experiment Station, University of Nebraska College of Agriculture, Lincoln, Nebraska 68503. Reprints of most journal articles may be obtained by writing directly to the authors.

Howard W. Ottoson
Director and Associate Dean

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Kermit Hansen, Omaha
Robert Koefoot, Grand Island
James Moylan, Omaha
Robert Prokop, Omaha
Robert Raun, Norman
Edward Schwartzkopf, Lincoln
Kermit Wagner, Schuyler
Durward B. Varner, Chancellor of the University
Robert G. Ross, Corporation Secretary and Vice Chancellor
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Virginia Trotter, Ph.D., Associate Director (and Dean, College of Home Economics)

W. W. Sahs, Ph.D., Assistant Director (and Supervisor, University Field Laboratory)

THE TECHNICAL STAFF

Agronomy

D. G. Hanway,^{1,2,3} Ph.D., Professor and Chairman of Department

A. R. Aandahl,² Ph.D., Professor, Soil Survey

Abraham Blum,² Ph.D., Visiting Professor, Sorghum Physiology

O. C. Burnside,^{1,2} Ph.D., Professor, Weed Science

D. F. Burzlaff,^{1,2} Ph.D., Professor, Range Management

Leon Chesnin,^{1,2} Ph.D., Associate Professor, Soil Chemistry

M. D. Clegg,² Ph.D., Assistant Professor, Sorghum Physiology

W. L. Colville,^{1,2} Ph.D., Professor, Crop Production

W. A. Compton,^{1,2} Ph.D., Associate Professor, Corn Breeding and Genetics

E. C. Conard,^{1,2} Ph.D., Associate Professor, Pasture Management

A. F. Dreier,^{2,3} M.Sc., Associate Professor, Crop Variety Evaluation

J. D. Eastin,² Ph.D., Associate Professor, Sorghum Physiology

L. F. Elliott,^{2,5} Ph.D., Assistant Professor, Soil Microbiology

J. R. Ellis,^{2,5} M.Sc., Instructor, Soil Microbiology

L. T. Empig,² Ph.D., Postdoctoral Fellow, Corn Breeding

A. D. Flowerday,^{2,3} Ph.D., Associate Professor and Vice Chairman of Department

C. O. Gardner,^{1,2} Ph.D., Professor, Statistics, Genetics

H. J. Gorz,^{2,5} Ph.D., Professor, Sweetclover

F. A. Haskins,^{1,2} Ph.D., Professor, Biochemical Genetics

J. L. Hughes,² Ph.D., Instructor, Soybean Breeding

J. H. Hultquist,^{2,5} M.Sc., Instructor, Sorghum Physiology

T. A. Jaynes,² Ph.D., Postdoctoral Fellow, Chemical Genetics

V. A. Johnson,^{2,5} Ph.D., Professor, Winter Wheat

W. R. Kehr,^{2,5} Ph.D., Professor, Alfalfa

R. F. Koenig,² M.Sc., Instructor, Sorghum Physiology

D. W. Lancaster,² M.Sc., Associate Professor, Crop Improvement

T. L. Lavy,^{1,2} Ph.D., Assistant Professor, Weed Science

D. T. Lewis,^{1,2} M.Sc., Instructor, Soil Survey

T. M. McCalla,^{1,2,5} Ph.D., Professor, Soil Microbiology

M. K. McCarty,^{2,5} Ph.D., Professor, Weed Science
 L. D. Maddux,² M.Sc., Instructor, Soil Fertility
 J. W. Maranville,² Ph.D., Assistant Professor, Sorghum Physiology
 P. J. Mattern,² M.Sc., Associate Professor, Cereal Quality
 A. P. Mazurak,^{1,2} Ph.D., Professor, Soil Physics
 L. N. Mielke,^{2,5} M.Sc., Soil Scientist, Soil Physics
 R. N. Mills,² M.Sc., Assistant Professor, Foundation Seed
 M. R. Morris,^{1,2} Ph.D., Professor, Cytogenetics
 L. A. Morrow,^{2,5} B.Sc., Instructor, Weed Science
 L. E. Moser,^{1,2} Ph.D., Associate Professor, Forage Physiology
 P. N. Mosher,² Ph.D., Postdoctoral Fellow, Soil Fertility
 L. C. Newell,^{2,5} Ph.D., Professor, Grass Improvement
 R. A. Olson,^{1,2} M.Sc., Professor, Soil Fertility
 G. A. Peterson,^{1,2} Ph.D., Assistant Professor, Soil Fertility
 L. R. Robison,^{2,3} Ph.D., Professor, Weed Science
 Wm. M. Ross,^{2,5} Ph.D., Professor, Sorghum Breeding
 D. H. Sander,^{2,3} Ph.D., Associate Professor, Soil Fertility
 E. C. Seim,² Ph.D., Postdoctoral Fellow, Soil Fertility
 J. W. Schmidt,^{1,2} Ph.D., Professor, Small Grain Breeding
 L. D. Schulze,² M.Sc., Instructor, Corn
 G. E. Schuman,^{2,5} M.Sc., Instructor, Soil Microbiology
 R. C. Sorensen,^{1,2} Ph.D., Assistant Professor, Soil Fertility
 J. E. Stroike,² M.Sc., Instructor, Wheat Breeding
 Larry Svajgr,² B.Sc., Instructor, Crop Improvement
 Tomoaki Taira,² M.Sc., Instructor, Cytogenetics
 R. A. Wiese,^{2,3} Ph.D., Associate Professor, Soil Fertility
 J. H. Williams,^{1,2} Ph.D., Associate Professor, Soybean Breeding

Animal Science

Frank H. Baker,^{1,2,3} Ph.D., Professor and Chairman of Department
 Charles H. Adams,^{1,2} Ph.D., Professor, Meats
 William T. Ahlschwede,^{2,3} Ph.D., Assistant Professor, Swine Breeding
 Martin A. Alexander,^{1,2,3} M.Sc., Professor, Sheep Products (Emeritus)
 Robert D. Appleman,^{1,2} Ph.D., Associate Professor, Dairy Products
 Vincent H. Arthaud,^{1,2} M.Sc., Associate Professor, Meats and Beef Products
 Marvel L. Baker,^{1,2} M.Sc., D.Sc., Professor Beef Breeding (Emeritus)
 Cecil T. Blum,^{1,2} Ph.D., Professor, Breeding & Genetics
 Larry V. Cundiff,^{2,5} Ph.D., Associate Professor, Beef Breeding
 P. J. Cunningham,^{1,2} Ph.D., Assistant Professor, Swine Breeding
 Gordon E. Dickerson,^{1,2,5} Ph.D., Professor, Breeding & Genetics
 Ted H. Doane,^{1,2,3} Ph.D., Associate Professor, Sheep Products
 Earl F. Ellington,^{1,2} Ph.D., Associate Professor, Beef Physiology

Paul Q. Guyer,^{2,3} Ph.D., Professor, Beef Nutrition
 James D. Heldt,^{2,3} M.Sc., Instructor, Swine Breeding
 Joseph M. Hudson,^{1,2} M.Sc., Instructor, General Animal Science
 Philip L. Kelly,^{1,2} Ph.D., Professor, Dairy
 Terry J. Klopfenstein,^{1,2} Ph.D., Associate Professor, Ruminant Nutrition
 Robert M. Koch,^{1,2} Ph.D., Professor, Beef Breeding
 Roger Mandigo,^{1,2,3} Ph.D., Associate Professor, Meats
 B. D. Moser,^{1,2} M.Sc., Instructor, Swine Nutrition
 Foster G. Owen,^{1,2} Ph.D., Professor, Dairy Nutrition
 Ernest R. Peo, Jr.,^{1,2} Ph.D., Professor, Swine Nutrition
 Mogens M. Plum,^{1,2} Ph.D., Professor, Dairy Breeding
 Andrew B. Schultze,^{1,2} Ph.D., Associate Professor, Reproduction Physiology
 John K. Ward,^{1,2} Ph.D., Associate Professor, Beef Nutrition
 Walter R. Woods,^{1,2} Ph.D., Professor, Beef Nutrition
 Dwane R. Zimmerman,^{1,2} Ph.D., Associate Professor, Swine Physiology

Biochemistry and Nutrition

R. L. Borchers,^{1,2} Ph.D., Professor and Chairman of Department
 J. M. Daly,^{1,2} Ph.D., Professor, Plant Intermediary Metabolism
 Richard Dam,^{1,2} Ph.D., Assistant Professor, Nutritional Biochemistry
 R. M. Hill,^{1,2} Ph.D., Associate Professor, Protein Biochemistry
 R. V. Klucas,^{1,2} Ph.D., Assistant Professor, Nitrogen Fixation
 H. W. Knoche,^{1,2} Ph.D., Associate Professor, Biochemical Endocrinology
 R. L. Ogden,² B.Sc., Assistant Professor, Alfalfa Processing
 F. W. Wagner,² Ph.D., Assistant Professor, Enzymes

Economics (Agricultural)

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 Dale Anderson,^{1,2} Ph.D., Associate Professor, Marketing
 Maurice Baker,^{1,2} Ph.D., Associate Professor, Land Economics
 Larry Bitney,^{2,3} Ph.D., Associate Professor, Farm Management
 H. W. Delvo,^{2,5} M.Sc., Instructor, Farm Management
 A. W. Epp,^{1,2} Ph.D., Professor, Farm Management
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 Loyd Fischer,^{1,2} Ph.D., Professor, Land Economics
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 James Hassler,^{1,2} Ph.D., Professor, Marketing and Price Analysis
 Delmer Helgeson,^{2,5} M.Sc., Instructor, Marketing
 Glen Helmers,^{1,2} Ph.D., Associate Professor, Production Economics
 P. A. Henderson,^{2,3} Ph.D., Professor, Farm Management
 R. D. Johnson,^{2,5} M.Sc., Instructor, Farm Management

James Kendrick,^{1,2} Ph.D., Professor, Marketing
 William Lagrone,^{2,5} M.Sc., Associate Professor, Production Economics
 Paul Lytle,^{1,2} Ph.D., Assistant Professor, Marketing
 John Muehlbeier,^{2,5} M.Sc., Professor, Land Economics
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 Allen Wellman,^{2,3} Ph.D., Assistant Professor, Marketing

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 Grant I. Johnson,^{2,3} B.A., Assistant Professor, Press
 John McLaughlin,^{1,2,3} B.Sc., Assistant Professor, Radio and Television

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 R. L. Peterson,^{1,2} Ed.D., Assistant Professor, Agricultural Education

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 J. A. DeShazer,^{1,2} Ph.D., Associate Professor, Livestock Facilities
 P. E. Fischbach,^{2,3} M.Sc., Professor, Irrigation Engineering
 C. B. Gilbertsen,^{2,5} M.Sc., Assistant Professor, Livestock Waste Management
 L. F. Larsen,² M.Sc., Professor, Tractor Testing
 C. L. Linderman,^{2,5} M.Sc., Instructor, Soil and Water Conservation
 D. M. Manbeck,^{1,2} Ph.D., Associate Professor, Natural Resources
 M. L. Mumgaard,² B.Sc., Assistant Professor, Tractor Testing
 S. O. Nelson,^{2,5} M.Sc., Associate Professor, Production Processing
 J. A. Nienaber,^{2,5} M.Sc., Instructor, Livestock Waste Management
 G. M. Peterson,^{1,2} M.Sc., Associate Professor, Farm Structures
 G. W. Steinbruegge,^{1,2} M.Sc., Professor, Land Locomotion
 L. E. Stetson,^{2,5} B.Sc., Instructor, Radio Frequency Energy
 N. P. Swanson,^{2,5} B.Sc., Assistant Professor, Soil and Water Conservation
 N. C. Teter,^{2,3} M.Sc., Associate Professor, Livestock Systems Engineering
 T. L. Thompson,^{1,2} Ph.D., Associate Professor, Product Processing and
 Systems Analysis
 K. L. Von Bargaen,^{1,2} Ph.D., Associate Professor, Systems Engineering

S. A. Weeks,² M.Sc., Instructor, Machinery
 U. E. Wendorff,^{1,2} M.Sc., Professor, Farm Machinery
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E. A. Dickason,^{1,2,3} Ph.D., Professor and Chairman of Department
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 G. L. Beland,^{2,5} M.Sc., Instructor, Forage Crops Insects
 J. H. Bell,^{2,5} B.Sc., Entomologist, Plant Pest Control
 T. J. Helms,^{1,2} Ph.D., Associate Professor, Insect Morphology and Pathology
 R. E. Hill,^{1,2} Ph.D., Professor, Insect Ecology (crop pests)
 C. M. Jones,^{2,5} M.Sc., Instructor, Livestock Insects
 S. D. Kindler,^{2,5} Ph.D., Assistant Professor, Forage Crops Insects
 G. R. Manglitz,^{2,5} Ph.D., Associate Professor, Forage Insect Investigations
 J. D. Munson,² Ph.D., Assistant Professor, Corn and Sorghum Insects
 K. P. Pruess,^{1,2} Ph.D., Associate Professor, Biology & Ecology of Crop Insects
 R. E. Roselle,^{2,3} M.Sc., Professor, Economic Entomology
 J. M. Schalk,^{2,5} Ph.D., Instructor, Forage Crop Insects
 Robert Staples,^{1,2} Ph.D., Associate Professor, Insect Transmission of Plant Pathogens

Food Science and Technology

T. E. Hartung,^{1,2,3} Ph.D., Professor and Chairman of Department
 R. G. Arnold,^{1,2,3} Ph.D., Associate Professor, Flavor Chemistry
 H. M. Barnhart, Jr.,^{1,2} M.Sc., Instructor, Food Technologist
 L. B. Bullerman,² Ph.D., Assistant Professor, Food Microbiology
 T. A. Evans,^{1,2,3} M.Sc., Associate Professor, Food Marketing Specialist
 R. B. Maxcy,^{1,2} Ph.D., Professor, Food Microbiology
 L. D. Satterlee,^{1,2} Ph.D., Assistant Professor, Food Protein Chemistry
 K. M. Shahani,^{1,2} Ph.D., Professor, Food Chemistry

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 E. J. Kinbacher,^{1,2} Ph.D., Professor, Physiology
 O. S. Malamud,² M.Sc., Instructor, Horticulture
 R. E. Neild,^{1,2} Ph.D., Associate Professor, Horticulture
 R. B. O'Keefe,^{1,2} Ph.D., Professor and Acting Chairman of Department
 R. A. Read,^{2,5} M.F., Associate Professor, Forestry

N. J. Rosenberg,^{1,2} Ph.D., Professor, Climatology
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 C. Y. Sullivan,² Ph.D., Associate Professor, Physiology
 D. F. Van Haverbeke,^{2,5} Ph.D., Associate Professor, Forestry

Plant Pathology

M. G. Boosalis,^{1,2,3} Ph.D., Professor and Chairman of Department
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 M. K. Brakke,^{2,5} Ph.D., Professor, Virus Diseases
 L. D. Dunkle,² Ph.D., Postdoctoral Fellow, Microbial Physiology
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 Glenn Peterson,^{2,5} Ph.D., Associate Professor, Tree Diseases
 M. L. Schuster,^{1,2} Ph.D., Professor, Nematode Diseases
 J. S. Semancik,^{1,2} Ph.D., Associate Professor, Virus Diseases
 J. R. Steadman,² Ph.D., Assistant Professor, Epidemiology of Vegetable Diseases
 J. L. Van Etten,^{1,2} Ph.D., Associate Professor, Microbial Physiology
 A. K. Vidaver,² Ph.D., Assistant Professor, Bacterial Diseases

Poultry Science

T. E. Hartung,^{1,2,3} Ph.D., Professor and Chairman of Department
 D. H. Free,^{1,2} B.Sc., Assistant Professor, Poultry Improvement
 G. W. Froning,^{1,2,3} Ph.D., Professor, Poultry Products
 E. W. Gleaves,^{2,3} Ph.D., Associate Professor, Poultry Nutrition
 F. Ben Mather,^{1,2} Ph.D., Assistant Professor, Poultry Physiology
 T. W. Sullivan,^{1,2,3} Ph.D., Professor, Poultry Nutrition
 H. L. Wieggers,^{1,2,3} M.Sc., Associate Professor, Poultry and Wildlife Management

Veterinary Science

M. J. Twiehaus,^{1,2,3} M.Sc., D.V.M., Professor and Chairman of Department
 R. E. Coupe,² B.Sc., Instructor, SPF Field Coordinator
 Michael Daharsh,² B.Sc., Assistant Instructor, SPF Swine
 J. W. Dunn,² D.V.M., Instructor, Swine Research
 D. L. Ferguson,^{1,2} Ph.D., Associate Professor, Parasitology
 O. D. Grace,^{1,2} M.Sc., D.V.M., Professor, Diagnostic Laboratory
 C. A. Mebus,^{1,2} D.V.M., Ph.D., Professor, Pathology
 K. C. Olson,² B.Sc., Instructor, SPF Swine
 L. C. Payne,^{1,2} D.V.M., Ph.D., Professor, Physiology
 M. B. Rhodes,² M.Sc., Assistant Professor, Enzymology of Parasites
 E. L. Stair,^{1,2} Ph.D., D.V.M., Associate Professor, Respiratory Diseases
 N. R. Underdahl,² B.A., M.Sc., Professor, Swine Diseases
 A. B. Welch,² M.Sc., Assistant Instructor, Viral Diseases Swine

Library

W. R. Collings,^{1,2} B.Sc., BLS, Senior Librarian

Statistics

W. M. Schutz,^{1,2} Ph.D., Professor and Chairman of Department

R. F. Mumm,^{1,2} Ph.D., Associate Professor, Statistical Consultant

Family Economics and Management

Gary D. Hansen,^{1,2,3} Ph.D., Associate Professor and Chairman of Department

Florence Walker,^{1,2} Ph.D., Associate Professor, Family Economics and Management

Lois Schwab,^{1,2} Ed.D., Associate Professor, Family Economics and Management

Food and Nutrition

Hazel M. Fox,^{1,2,3} Ph.D., Professor and Chairman of Department

Constance Kies,^{1,2} Ph.D., Professor, Food and Nutrition

Marie Knickrehm,^{1,2} Ph.D., Professor, Institutional Administration

Pauline Paul,^{1,2} Ph.D., Professor, Food and Nutrition

Diane Ferger,^{1,2} M.Sc., Instructor, Food and Nutrition

Home Economics Education

Shirley Kreutz,^{1,2} Ed.D., Associate Professor and Acting Chairman of
Department

Hazel Anthony,^{1,2} Ed.D., Professor and Associate Dean of the College of
Home Economics

Hazel Crain,^{1,2} Ph.D., Assistant Professor, Home Economics Education

Human Development and the Family

J. C. Woodward,^{1,2,3} Ph.D., Professor and Chairman of Department

Ruby Gingles,^{1,2} M.Sc., Professor, Human Development and the Family

Violet Kalyan-Masih,^{1,2} Ph.D., Assistant Professor, Human Development and
the Family

Jacqueline Voss,^{1,2} Ed.D., Assistant Professor, Human Development and the
Family

Textiles, Clothing and Design

Audrey Newton,^{1,2,3} Ph.D., Professor and Chairman of Department

Patricia Sailor,^{1,2} Ph.D., Associate Professor, Textiles, Clothing and Design

Barbara Scrubbs,^{1,2} M.Sc., Instructor, Textiles, Clothing and Design

Regional Stations

Northeast Station, Concord, Nebraska

Cal J. Ward,^{2,3} Ph.D., Associate Professor and Superintendent of Station
W. F. Fisher,^{2,3} M.Sc., Assistant Professor, Agricultural Engineering
R. D. Fritschen,^{2,3} M.Sc., Assistant Professor, Animal Science
Russell S. Moomaw,^{2,3} M.Sc., Assistant Professor, Agronomy
George W. Rehm,^{2,3} Ph.D., Assistant Professor, Agronomy
Walter L. Tolman,^{2,3} B.Sc., Assistant Professor, Animal Science

North Platte Station, North Platte, Nebraska

Leslie F. Sheffield,^{2,3} Ph.D., Assistant Professor and Superintendent of Station
John B. Campbell,^{2,3} Ph.D., Assistant Professor, Entomology
D. C. Clanton,^{2,3} Ph.D., Professor, Animal Science (Beef)
D. M. Danielson,² Ph.D., Associate Professor, Animal Science (Swine)
P. H. Grabouski,² B.Sc., Assistant Professor, Agronomy (Outstate Testing)
C. M. Hibbs,² D.V.M., Ph.D., Associate Professor, Veterinary Science
J. T. Nichols,^{2,3} Ph.D., Associate Professor, Agronomy (Range Management)
P. T. Nordquist,² Ph.D., Assistant Professor, Agronomy (Sorghum Breeding)
Robert E. Perry,^{2,3} M.Sc., Associate Professor, Agricultural Economics
James L. Peters,^{2,3} M.Sc., Assistant Professor, Information
Myron G. A. Rumery,² B.Sc., Associate Professor, Animal Science (Beef)
D. E. Smika,^{2,5} Ph.D., Assistant Professor, Agronomy (Soils)
B. R. Somerhalder,^{2,3} M.Sc., Associate Professor, Agricultural Engineering
R. D. Uhlinger,² Ph.D., Associate Professor, Horticulture and Forestry
R. G. White,² D.V.M., B.Sc., Assistant Professor, Veterinary Science
G. A. Wicks,² M.Sc., Assistant Professor, Agronomy (Weed Science)

Scotts Bluff Station, Mitchell, Nebraska

Lionel Harris,^{2,3} M.Sc., Superintendent of Station
F. N. Anderson,² M.Sc., Assistant Professor, Agronomy
C. L. Ashburn,^{2,3} B.Sc., Associate Professor, Farm Management Specialist
L. A. Daigger,^{2,3} M.Sc., Associate Professor, Area Specialist, Soils
C. R. Fenster,^{2,3} B.Sc., Associate Professor, Crop Management
A. F. Hagen,^{2,3} M.Sc., Assistant Professor, Entomology
R. H. Hatch,^{2,3} Ph.D., Assistant Professor, Animal Science
E. D. Kerr,^{2,3} Ph.D., Assistant Professor, Plant Pathology
D. C. Kincaid,^{2,5} Ph.D., Assistant Professor, Agricultural Engineering
L. A. Nelson,^{2,3} Ph.D., Assistant Professor, Agronomy
D. S. Nuland,^{2,3} M.Sc., Assistant Professor, Horticulture and Forestry
Hollis Shull,^{2,5} M.Sc., Associate Professor, Agricultural Engineering
C. I. Walters,^{2,3,6} B.Sc., Assistant Superintendent

J. S. Webster,² M.Sc., Assistant Professor, Agronomy; Manager of Northwest
Agricultural Laboratory

South Central Station, Clay Center, Nebraska

Charles L. Stonecipher,^{2,3} Ph.D., Associate Professor, Superintendent
Kenneth D. Frank,^{2,3} Ph.D., Assistant Professor, Agronomy

U.S. Meat Animal Research Center, Clay Center, Nebraska

K. E. Gregory,^{2,5} Ph.D., Director of Center
T. E. Bond,^{2,5} Ph.D., Research Engineer
Lamoine Brownlee,^{2,5} M.Sc., Farm and Maintenance Operations Manager
John Crouse,^{2,5} Ph.D., Food Technologist
G. E. Dickerson,^{2,5} Ph.D., Research Geneticist
Hudson Glimp,^{2,5} Ph.D., Research Chemist
Robert Graham,^{2,5} B.Sc., M.E., General Engineer
R. D. Humphrey,^{2,5} M.Sc., Animal Science
Danny Laster,^{2,5} Ph.D., Research Physiologist
Walt Rowden,^{2,5} M.Sc., Livestock Operations Manager
Gene Vanderbur,^{2,5} B.Sc., Assistant to the Director

University of Nebraska Field Laboratory, Mead, Nebraska

Warren W. Sabs,² Ph.D., Supervisor of Field Laboratory
F. C. Hastert,² B.Sc., Facilities Manager

¹Teaching Staff

²Station Staff

³Extension Staff

⁴Leave of Absence

⁵Cooperative, USDA

⁶Deceased

NEBRASKA AGRICULTURAL EXPERIMENT STATION RESEARCH PROJECTS

Research projects are listed in order by subject matter departments. An asterisk (*) indicates that the project was discontinued in fiscal 1970-1971.

Administration

- 1-1 General administration of federal grant funds research. E. F. Frolik and H. W. Ottoson.
- 1-2 The planning and coordination of cooperative regional research. H. W. Ottoson.
- 1-3 Administration of federal grant marketing research funds. H. W. Ottoson.
- 1-4 Regional Research Coordination, North Central Region. H. W. Ottoson.

Agricultural Economics

- 10-1 Farm business and enterprise analysis. A. W. Epp.
- 10-12 An economic analysis of the farm real estate market in Nebraska. J. D. Greer.
- 10-17 Economic and legal factors in providing, using and managing water resources in agriculture. L. K. Fischer.
- 10-34 Economics of beef production in range areas of Nebraska. A. W. Epp.
- 10-40 Implications of the European common market for midwestern agriculture. J. G. Kendrick.
- 10-43 Adjustment opportunities for wheat farms. G. T. Vollmar.
- 10-44 An economic evaluation of new technological developments in the swine industry and alternative systems of producing swine in Nebraska. P. A. Henderson.
- *10-45 Economic factors affecting sugar marketing. Michael Turner.
- 10-46 Dairy market adjustment problems in the North Central region. T. A. Evans.
- 10-47 Long run adjustments in livestock market organization in the North Central region. J. G. Kendrick and J. B. Hassler.
- 10-48 Economic growth of Nebraska farm and ranch firms. J. B. Hassler.
- *10-50 Impact of changing international trade in grain on marketing. M. S. Turner.
- 10-51 Least cost formulation of recommended livestock and poultry rations. J. G. Kendrick and Foster G. Owen.
- *10-52 Cooperative enterprise in the U. S. economy: economic impacts and potential role. D. G. Anderson.

- 10-53 Feed-livestock sector: data relevance and information service programs. J. B. Hassler and J. W. Trierweiler.
- 10-54 An economic appraisal of input purchasing in feeding, buying, and selling of cattle. R. D. Johnson
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Departmental Reports

Department of Agricultural Education

Report Number 31, Summaries of Studies in Agricultural Education Central Region 1969-70. James T. Horner.

Report Number 32, Management Education for Farmers and Ranchers. James T. Horner.

Report Number 33, Identifying Major Tasks Performed By Food Service Workers in Commercial and Institutional Food Serving Establishments. Mary Ann Grieser.

Report Number 34, The Nebraskaland Vo Ag Program in Adult Farm and Ranch Business Management Education. Roland Peterson.

Report Number 35, The Future Design for Agribusiness Education. Roy D. Dillon.

Department of Food and Nutrition

Report Number 3, Food and Nutrition Education in a Day Care Program for Mentally Disturbed Women. Margaret Wilkinson, Elinor Kerrey, Ruth Ganshorn and Constance Kies.

Report Number 4, School Food Service Managers Shortcourse. Curriculum with Objectives, Desired Competencies, Learning Activities and Teaching Methods Resource Materials. Marie Penner.

Department of Horticulture and Forestry

Report Number 83, The Effect of Antitranspirant Materials. Tom Hale.

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Key to Abbreviations

SB—Station Bulletin	Anderson, L. W., Q4
RB—Research Bulletin	Anderson, R. B., J3179
DR—Departmental Report	Anderson, Robert L., J2973a
OTC—Outstate Testing Circular	Andrews, R. P., J2411
M—Miscellaneous Publication	Appleman, R. D., J3088a, J3097a
Q2—Summer Quarterly 1970	Arnold, R. G., J2888, J2901,
Q3—Fall Quarterly 1970	J3001, J3091a, J3095a, J3144a,
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 Seim, E. C., J3184a
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 J2576, J2753, J2963, J3065,
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 Speece, Jane, Q2
 Spomer, R. G., J3046, J3130a
 Stair, E. L., J3004, J3185
 Staples, R., Q4, J2256, J2296,
 J2311, J2443, J2796, J2923,
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 Steadman, J. R., DR84, J3044a
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 Thomas, Mary E., J3108
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 Tolman, W., Q2
 Trierweiler, John E., RB240
 Trocha, Paul, J3106
 Twiehaus, Marvin J., J2683, J2811,
 J3004, J3045, J3149s, J3185
 Udea, S., J2479
 Ulmer, R. L., J3072
 Underdahl, Norman R., J2332,
 J2811, J3004, J3149s, J3185
 Vakil, J. R., J2576, J2753
 VanEtten, James L., J2316, J2976,
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Van Pelt, Nancy, J2686, J2764
 Varner, Larry, J3020, J3060,
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 Vetter, D. J., Q4
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 Volkmer, George H., J2146
 Vollmar, Glen J., SB514
 Von Bargen, Kenneth, J3043
 Voss, Jacqueline H., J3137, J3138
 Wagner, Fred W., J2919, J2934a,
 J3051
 Walsh, R. G., SB512, J2438, J2490
 Warnes, D. D., RB241, J2520
 Weathers, L. G., J3112a
 Webster, J. S., OTC142, OTC144
 Weekman, G. T., J2313
 Weeks, R. C., 3141a
 Weeks, Stanley W., J3002
 Weihing, John L., Q3, Q4, J3049,
 J3089
 Weitzel, J. A., OTC141, OTC142,
 OTC144
 Welch, Ardyce, B., J2951
 Wellman, Allen C., Q2
 Wendorff, Urban E., J3002
 White, R. Gene, J3156a, J3163
 Wicks, G. A., J2416, J2447, J2496,
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 J3007a, J3018, J3021a, J3022a,
 J3023a, J3025a, J3030, J3031a,
 J3032a, J3074, J3118, J3132,
 J3165
 Wilhelm, Mari S., J2993
 Wilkinson, Margaret, DR3, J3048
 Williams, Eleanor R., J1704
 Williams, J. H., J2153, J3070
 Willis, William G., J2358
 Wittmuss, Howard W., Q1, J2320
 Wolff, I. A., J2635
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 Works, D. W., J2212
 Wysong, David S., J2358
 Ying, Cheng-Chun, J3129
 Young, Loyd, Q1
 Zikmund, Dale G., J2790, J2822,
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**THE UNIVERSITY OF NEBRASKA
AGRICULTURAL EXPERIMENT STATIONS**

**REPORT OF INCOME AND EXPENDITURES
For the Year Ended June 30, 1971**

GENERAL CURRENT FUNDS

Funds Available:

Received from United States Government

Hatch Fund \$ 789,142.00

Budgeted by the University 3,920,582.45

Total \$4,709,724.45

Expenditures:

Salaries, Wages, and Staff Benefits . . \$3,682,367.66

Operating Expense 763,972.14

Equipment and Improvements 263,384.65

Total \$4,709,724.45

RESTRICTED CURRENT FUNDS

Income:

Gifts, Grants, and Contracts

From United States Government

Agencies \$1,380,924.57

From State of Nebraska Agencies . . . 95,121.73

From Industry 251,651.21

From Foundations & Health

Organizations 111,215.03

From Other Sources 5,638.13

Total \$1,844,550.67

Expenditures:

Salaries, Wages, and Staff Benefits . . \$1,032,720.36

Operating Expenses 670,316.73

Equipment and Improvements 141,513.58

Total \$1,844,550.67

CASH AUXILIARY FUND

Income:

Sales and Services \$2,800,679.54

Expenditures:

Salaries, Wages, and Staff Benefits . . .	846,018.56
Operating Expenses	1,379,441.19
Equipment and Improvements	575,219.79
Total	\$2,800,679.54