

## NORTHEAST EXPERIMENT STATION

M. J. THOMPSON, M.S., Superintendent

## NORTHWEST EXPERIMENT STATION

T. M. McCALL, M.S., Superintendent  
 O. C. SOINE, Ph.D., Associate Agronomist  
 B. C. BERESFORD, M.S., Assistant Horticulturist  
 A. M. FOKER, Assistant Agricultural Engineer  
 O. M. KISER, M.S., Assistant Animal Husbandman  
 H. W. SODERBURG, M.A., Assistant Agricultural Engineer  
 \*H. D. FAUSCH, B.S., Assistant in Animal Husbandry  
 A. M. PILKEY, Assistant in Poultry Husbandry

## SOUTHEAST EXPERIMENT STATION

R. E. HODGSON, M.S., Superintendent

## WEST CENTRAL EXPERIMENT STATION

A. W. EDSON, M.S., Superintendent  
 R. O. BRIDGFORD, M.S., Associate Agronomist  
 \*A. C. HEINE, B.S., Associate Agricultural Engineer and Assistant Superintendent  
 P. S. JORDAN, B.S., Associate Animal Husbandman  
 H. G. CROOM, B.S., Assistant Poultry Husbandman and Assistant Superintendent  
 \*B. E. YOUNGQUIST, B.S., Assistant Agricultural Engineer  
 L. K. LINDOR, B.S., Assistant in Agricultural Engineering

## PUBLICATIONS

HAROLD B. SWANSON, M.S., Editor  
 JOSEPHINE B. NELSON, M.A., Instructor, Extension Assistant Editor  
 ROBERT G. RUPP, B.S., Instructor and Extension Information Specialist  
 \*LETTIE GUDMESTAD, B.A., Assistant to Editor, Agricultural Bulletins  
 \*MARGARET NIELSEN, B.A., Assistant to Editor, Agricultural Bulletins

\* On leave July 1, 1949, to August 31, 1949; May 1, 1950, to June 30, 1950

\* SEE Agricultural Experiment Station—Rosemount

\* On leave July 1, 1949, to June 30, 1950

\* Resigned September 12, 1949

\* Appointed September 6, 1949

## FIFTY-SEVENTH ANNUAL REPORT

# Agricultural Experiment Station

## University of Minnesota

JULY 1, 1949 TO JUNE 30, 1950



UNIVERSITY FARM, ST. PAUL

LETTERS OF TRANSMITTAL

University of Minnesota, Minneapolis, Minn.

July 1, 1950

To His Excellency, Luther W. Youngdahl,  
Governor of Minnesota.

SIR: I have the honor to transmit to you herewith the report of the Agricultural Experiment Station of the University of Minnesota for the fiscal year ending June 30, 1950.

Respectfully transmitted,

JAMES L. MORRILL,  
President of the Board of Regents

University of Minnesota, Minneapolis, Minn.

July 1, 1950

To the Honorable Board of Regents,  
University of Minnesota.

GENTLEMEN: I have the honor to transmit herewith the report of the Director of the Agricultural Experiment Station of the University of Minnesota for the fiscal year ending June 30, 1950.

Respectfully transmitted,

JAMES L. MORRILL,  
President of the University of Minnesota

University Farm, St. Paul, Minn.

July 1, 1950

James L. Morrill,  
President of the University of Minnesota.

SIR: I have the honor to submit herewith the report of the Agricultural Experiment Station for the fiscal year ending June 30, 1950.

Respectfully submitted,

H. MACY, Director

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FIFTY-SEVENTH ANNUAL REPORT  
AGRICULTURAL EXPERIMENT STATION  
UNIVERSITY OF MINNESOTA

JULY 1, 1949 TO JUNE 30, 1950

C. H. Bailey, Director  
H. Macy, Associate Director

FOREWORD

Agricultural research, like other areas of human interest, is being organized and conducted on regional, national, and even on an international scale to an increasing degree. It is becoming recognized by many that an agricultural problem is not ordinarily confined to any specific or single political unit or state, and that the solution of the problem may find wide application far beyond the boundaries of any one state.

Moreover, a research undertaking may be much more effective, both in terms of the time required for its completion and the adequacy of the findings, when several agencies or units are involved in the researches. Accordingly, the increasing development of regional and national projects in recent times is utterly logical and serves to accelerate progress toward prompt and effective solution of the problems they are attempting to solve.

One of the contributing factors to the increased efficiency of such joint undertakings is that the project leaders and researchers concerned are brought together in conferences. Thus, the exchange of knowledge and ideas, the division of responsibilities, and the arrangements for wide dissemination of the significant findings are effectuated on an area or problem basis. All of these contribute to the ultimate usefulness of the findings and the returns per dollar of investment in the research programs.

In many of these cooperative projects the Minnesota Agricultural Experiment Station participates actively. They cover as wide a range as, for example, crop breeding, swine breeding, cattle breeding, poultry breeding, numerous phases of marketing research, and nutrition of man and animals. In various instances several of the branch experiment stations in this state are utilized in the studies. Thus, there is an economical use of land and physical plant as well as of scientific personnel.

At the same time it is recognized that too wide a physical distribution of such research activities in any single state may become hazardous and wasteful. Thus, many projects necessitate the application of the joint activities of various specialists who are attached to numerous departments. These must be housed

in the same institution or unit in order to enable them to work effectively as a team.

Also, the costs per unit of accomplishment may tend to mount if many inadequately staffed research groups are substituted for a few units, each provided with thoroughly competent and well-balanced personnel. Then there are the issues of library facilities and of special equipment, including buildings and laboratories, to consider.

It results, therefore, that sound research administration involves the recruitment of restricted numbers of well-trained and competent scientists and the provision of adequate facilities within the range of the research budget. Such units can be tied into cooperative activities with other states, federal bureaus, and even at times with private organizations or foreign institutions, in a manner and to a degree that will result in the largest returns to all concerned. This is the trend of the times, and one of the major developments in agricultural research that can be recorded now, at the turn of the second half of the twentieth century.

## CHANGES IN STAFF

## Appointments

- C. M. Bemis, D.V.M., as instructor, Division of Veterinary Medicine, effective July 16, 1949.
- E. E. Butler, M.S., as research fellow, Division of Plant Pathology and Botany, effective February 16, 1950.
- T. M. Christison, B.S., M.A., as instructor, Division of Veterinary Medicine, effective July 1, 1949.
- E. F. Cook, Ph.D., as instructor, Division of Entomology and Economic Zoology, effective October 1, 1949.
- R. B. England, D.V.M., B.S.A., as instructor, Division of Veterinary Medicine, effective September 16, 1949.
- T. A. Gochnauer, Ph.D., as research associate, Division of Entomology and Economic Zoology, effective October 1, 1949.
- A. C. Heine, B.S., as associate professor and superintendent, Agricultural Experiment Station, Rosemount, effective July 16, 1949.
- A. N. Korsunsky, V.D., as research fellow, Division of Veterinary Medicine, effective October 1, 1949.
- I. E. Liener, Ph.D., as instructor, Division of Agricultural Biochemistry, effective July 1, 1949.
- Travis R. Manning, M.S., as research fellow, Division of Agricultural Economics, effective February 6, 1950.
- R. A. Merrill, D.V.M., as associate professor, Division of Veterinary Medicine, effective January 1, 1950.
- W. F. Millier, Ph.D., as research fellow, Division of Agricultural Engineering, effective December 1, 1949.
- J. E. Moulton, D.V.M., B.S., as instructor, Division of Veterinary Medicine, effective July 1, 1949.
- Margaret Nielsen, B.A., as assistant to editor, Agricultural Bulletins, Division of Publications, effective September 6, 1949.
- A. E. Schneider, M.A., as associate professor, School of Forestry, effective September 1, 1949.
- C. C. Turbes, D.V.M., M.S., as instructor, Division of Veterinary Medicine, effective September 16, 1949.
- A. F. Weber, D.V.M., Ph.D., as assistant professor, Division of Veterinary Medicine, effective August 16, 1949.
- R. E. Widmer, M.S., as instructor, Division of Horticulture, effective July 1, 1949.

## Promotions

- G. M. Briggs, Ph.D., assistant professor to associate professor, Division of Poultry Husbandry, effective July 1, 1949.
- P. M. Burson, M.S., associate professor to professor, Division of Soils, effective July 1, 1949.

- J. N. Campbell, D.V.S., B.S., associate professor to professor, Division of Veterinary Medicine, effective July 1, 1949.
- R. W. Cox, Ph.D., assistant professor to associate professor, Division of Agricultural Economics, effective July 1, 1949.
- H. G. Croom, B.S., assistant professor to assistant professor and assistant superintendent, West Central Experiment Station, effective July 16, 1949.
- E. F. Ferrin, M.Agr., professor to professor and chief, Division of Animal Husbandry, effective December 16, 1949.
- A. M. Flikke, M.S., instructor to assistant professor, Division of Agricultural Engineering, effective July 1, 1949.
- T. W. Gullickson, Ph.D., associate professor to professor, Division of Dairy Husbandry, effective July 1, 1949.
- A. C. Heine, B.S., assistant professor and assistant superintendent to associate professor and assistant superintendent, West Central Experiment Station, effective July 1, 1949; became associate professor and superintendent, Agricultural Experiment Station, Rosemount, July 16, 1949.
- M. F. Kernkamp, Ph.D., assistant professor to associate professor, Division of Plant Pathology and Botany, effective July 1, 1949.
- J. W. Lambert, Ph.D., assistant professor to associate professor, Division of Agronomy and Plant Genetics, effective July 1, 1949.
- J. M. MacGregor, Ph.D., assistant professor to associate professor, Division of Soils, effective July 1, 1949.
- W. H. Marshall, Ph.D., associate professor to professor, Division of Entomology and Economic Zoology, effective July 1, 1949.
- Josephine B. Nelson, M.A., informational representative to instructor and extension assistant editor, Division of Publications, effective July 1, 1949.
- C. K. Otis, M.S., associate professor to professor, Division of Agricultural Engineering, effective July 1, 1949.
- R. A. Phillips, M.S., instructor to assistant professor, Division of Horticulture, effective July 1, 1949.
- E. H. Rinke, Ph.D., associate professor to professor, Division of Agronomy and Plant Genetics, effective July 1, 1949.
- J. H. Sautter, D.V.M., Ph.D., assistant professor to associate professor, Division of Veterinary Medicine, effective July 1, 1949.
- A. R. Schmid, Ph.D., assistant professor to associate professor, Division of Agronomy and Plant Genetics, effective July 1, 1949.
- A. F. Sellers, D.V.M., Ph.D., instructor to associate professor, Division of Veterinary Medicine, effective October 16, 1949.
- R. N. Shoffner, Ph.D., assistant professor to associate professor, Division of Poultry Husbandry, effective July 1, 1949.
- O. C. Soine, Ph.D., assistant professor to associate professor, Northwest Experiment Station, effective July 1, 1949.



## Leaves of Absence

A. L. Burroughs, Ph.D., assistant professor, Division of Entomology and Economic Zoology, to continue research work for the U. S. Army in Japan, July 1, 1949, to June 30, 1950.

J. J. Christensen, Ph.D., professor, Division of Plant Pathology and Botany, on leave to Japan to study and develop an improved disease control program for food crops, March 1, 1950, to April 30, 1950; June 1, 1950, to June 30, 1950.

H. D. Fausch, B.S., instructor, Northwest Experiment Station, to continue graduate work in animal husbandry at the University of Minnesota, July 1, 1949, to August 31, 1949; May 1, 1950, to June 30, 1950.

W. A. Malmquist, D.V.M., instructor, Division of Veterinary Medicine, to continue research on foot-and-mouth disease for the Bureau of Animal Industry, U. S. Department of Agriculture, at Lindholm, Denmark, July 1, 1949, to June 30, 1950.

Lowry Nelson, Ph.D., professor, Division of Rural Sociology, on leave to teach at Utah State Agricultural College, Logan, Utah, March 16, 1950, to June 15, 1950.

W. M. Sandstrom, Ph.D., professor, Division of Agricultural Biochemistry, on leave due to illness, November 21, 1949, to December 31, 1949; April 17, 1950, to May 15, 1950.

A. J. Schwantes, M.S., professor and chief, Division of Agricultural Engineering, to continue experimental work for the Ford Motor Company, St. Paul, Minnesota, July 1, 1949, to September 30, 1949.

B. E. Youngquist, B.S., assistant professor, West Central Experiment Station, to continue graduate work at the University of Minnesota, July 1, 1949, to June 30, 1950.

## Resignations

C. W. Bice, Ph.D., research fellow, Division of Agricultural Biochemistry, to accept a position as research leader, R. T. French Company, Rochester, New York, effective January 31, 1950.

R. A. Bottomley, Ph.D., assistant professor, Division of Agricultural Biochemistry, to accept a position as director of research, Golden Crust Bakeries Ltd., North Adelaide, South Australia, effective September 20, 1949.

G. H. Conner, D.V.M., M.S., instructor, Division of Veterinary Medicine, to accept a position with the College of Veterinary Medicine, Pullman, Washington, effective June 30, 1950.

B. M. Craig, Ph.D., research fellow, Division of Agricultural Biochemistry, to accept a position as biochemist, Prairie Regional Laboratory, Saskatoon, Saskatchewan, Canada, effective May 31, 1950.

J. M. Daly, M.S., instructor, Division of Plant Pathology and Botany, to accept a position as teaching assistant in the Botany

Department, University of Minnesota, Minneapolis, Minnesota, effective December 31, 1949.

Lettie Gudmestad, B.A., assistant to editor, Agricultural Bulletins, Division of Publications, to accompany husband to his new position, effective September 12, 1949.

Frederick Kristjanssen, M.S., research fellow, Division of Animal Husbandry, to accept a position with the Dominion Experimental Farms, Ottawa, Canada, effective September 20, 1949.

J. E. Moulton, D.V.M., B.S., instructor, Division of Veterinary Medicine, to accept American Veterinary Medical Association Fellowship to pursue graduate work at the University of Minnesota, effective June 30, 1950.

W. A. Oitto, B.S., research fellow, Division of Horticulture, to reside at home in Nemo, South Dakota, effective June 30, 1950.

Marguerite L. Paulsen, M.S., instructor, School of Home Economics, to accept a teaching position at the College of Puget Sound, Tacoma, Washington, effective June 15, 1950.

C. B. Roubicek, M.S., research fellow, Division of Animal Husbandry, to accept a position in the Animal Husbandry Department, University of Wyoming, Laramie, Wyoming, effective August 1, 1949.

C. F. Sierk, Ph.D., associate professor, Division of Animal Husbandry, to accept a position as assistant coordinator of Beef Cattle Research, Bureau of Animal Industry, U. S. Department of Agriculture, Denver, Colorado, effective May 12, 1950.

R. J. Stenberg, Ph.D., research fellow, Division of Agricultural Biochemistry, to accept a position as biochemist, Physicians and Hospital Supply Company, Minneapolis, Minnesota, effective June 30, 1950.

## Retirements

Wylle B. McNeal, M.A., professor and director, School of Home Economics, effective June 30, 1950.

A. G. Tyler, B.S., assistant professor, Division of Agricultural Engineering, effective June 15, 1950.

## Deaths

W. H. Peters, M.Agr., professor and chief, Division of Animal Husbandry, August 8, 1949.

## PUBLICATIONS

## AGRICULTURAL EXPERIMENT STATION

## General Bulletin Series

403. (Reprint) Sex determination of geese. Thomas H. Canfield, Poultry Husbandry. 6 pages, 2,500.
405. Starting farming in southeastern Minnesota. Raymond R. Beneke and George A. Pond, Agricultural Economics. 20 pages, 7,500.
406. (Regional Bulletin 16) Relationship of price and quality of potatoes at retail level. R. A. Kelly, H. O. Werner, F. A. Krantz, Perry Hemphill, and M. E. Cravens, Horticulture. 28 pages, 12,000.

## Technical Bulletin Series

187. Marketing slaughter hogs by carcass weight and grade. Gerald Engelman, Austin A. Dowell, Evan F. Ferrin, and Philip A. Anderson, Agricultural Economics and Animal Husbandry. 88 pages, 5,000.
188. Combining ability in tomatoes. John F. Moore and T. M. Currence, Horticulture. 24 pages, 3,000.
189. Reciprocal crosses in the squash, *Cucurbita maxima* Duch. Edward P. Lana, Horticulture. 28 pages, 3,000.
190. Environmental factors relating to the pre-emergence treatment of corn with 2,4-D and soybeans with TCA. H. R. Arakeri and R. S. Dunham, Agronomy and Plant Genetics. 28 pages, 4,000.
191. The genealogy of an inbred Poland China herd of swine. E. W. Stringam, L. M. Winters, and P. S. Jordan, Animal Husbandry. 32 pages, 3,000.
192. The black flies of Minnesota. H. Page Nicholson and Clarence E. Mickel, Entomology and Economic Zoology. 64 pages, 2,500.
193. A genealogical study of the Minnesota No. 2 hog. Carl B. Roubicek, L. M. Winters, and O. M. Kiser, Animal Husbandry. 32 pages, 2,500.

## Minnesota Farm and Home Science

- Volume VII, Number 1. 16 pages, 16,500.
- Volume VII, Number 2. 16 pages, 16,250.
- Volume VII, Number 3. 20 pages, 16,300.

## Report Series

- Fifty-sixth Annual Report of the Minnesota Agricultural Experiment Station, July 1, 1948, to June 30, 1949. 36 pages, 2,500.

Miscellaneous Report No. 8. Varietal trials of farm crops. H. K. Hayes, E. R. Ausemus, J. O. Culbertson, J. W. Lambert, and R. G. Robinson, Agronomy and Plant Genetics. 20 pages, 12,500.

Miscellaneous Report No. 9. Maturity ratings of corn hybrids registered for sale in Minnesota in 1949. E. H. Rinke, Gertrud Joachim, N. C. Olmeim, Agronomy and Plant Genetics. 12 pages, 5,000.

## AGRICULTURAL EXTENSION SERVICE

## Bulletin Series

119. (Revised) Hog health makes wealth. H. G. Zavoral, Agricultural Extension. 16 pages, 10,000.
146. (Revised) Beef production. W. E. Morris and A. L. Harvey, Agricultural Extension and Animal Husbandry. 28 pages, 10,000.
250. (Reprint) Landscaping the farmstead. Leon C. Snyder, Horticulture. 24 pages, 10,000.
255. (Revised) The home fruit planting. Leon C. Snyder, Horticulture. 32 pages, 10,000.
257. 1950 recommendations for corn borer control (supplement to Fighting the European corn borer in Minnesota). F. G. Holdaway, L. K. Cutkomp, and A. W. Buzicky, Entomology and Economic Zoology. 4 pages, 20,000.
259. Frozen food locker plants and home freezers in Minnesota. Robert E. Olson and D. C. Dvoracek, Agricultural Economics and Agricultural Extension. 16 pages, 10,000.
260. Our soil to use. Soils. 44 pages, 15,000.
261. Soap and other detergents. Mary May Miller, Agricultural Extension. 8 pages, 25,000.
262. Reupholstering at home. Helen H. Matheis, Agricultural Extension. 28 pages, 20,000.

## Pamphlet Series

97. (Revised) Best buys in fruits and vegetables. Agricultural Extension. 6 pages, 10,000.
134. (Revised) Custom rates for farm operations. B. F. Stanton and T. R. Nodland, Agricultural Economics. 6 pages, 7,500.
169. 1950 farm business planning. Agricultural Extension. 8 pages, 15,000.
170. 1950 dairy products, eggs, and poultry. Mary Killen and M. K. Hinds, Agricultural Economics and Agricultural Extension. 8 pages, 10,000.
171. 1950 family living. Agricultural Extension. 8 pages, 7,000.

172. (Original and reprint) Agricultural Act of 1949. D. C. Dvoracek, Agricultural Extension. 4 pages, 20,000.

#### Folder Series

62. (Revised) Legume and grass mixtures. Ralph F. Crim and A. R. Schmid, Agricultural Extension and Agronomy and Plant Genetics. 8 pages, 15,000.

85. (Revised) Tips on tree planting. Parker Anderson, Agricultural Extension. 6 pages, 10,000.

100. (Revised) Home canning fruits and vegetables. Ina Rowe and Inez Hobart, Agricultural Extension. 8 pages, 30,000.

134. (Reprint) What is a good farm house. Mary May Miller, Agricultural Extension. 8 pages, 15,000.

140. (Revised) Windbreaks for field protection. Parker Anderson, Agricultural Extension. 6 pages, 20,000.

145. (Revised) Fertilizer grades and ratios for Minnesota. C. O. Rost, Paul M. Burson, E. R. Duncan, and H. E. Jones, Soils. 12 pages, 30,000.

147. (Revised) Livestock pest control. W. E. Morris, H. L. Parten, and H. J. Griffiths, Agricultural Extension, Entomology and Economic Zoology, and Veterinary Medicine. 8 pages, 15,000.

148. (Revised) Use built-up litter in your poultry house. Agricultural Extension. 4 pages, 10,000.

#### Newsletters

Name of publication	Issues	Pages	Circulation
Ask University Farm .....	12	53	2,794
Bob Hodgson's Farm Talks .....	12	102	1,461
Club Leader Letter .....	3	12	14,400
Dairy Herd Improvement Association Letter .....	4	21	12,094
Farm Business Notes .....	7	28	22,975
Garden Fact Sheet .....	9	23	1,656
Home Garden Tips .....	9	36	2,472
Information Letter for Market Gardeners .....	2	4	2,516
Minnesota Farm and Home Science .....	3	52	49,050
Minnesota Rural Youth .....	3	12	7,950
Our Land .....	9	40	3,738
Poultry News Letter .....	6	16	2,250
Reaching Rural People .....	12	27	1,548
Turkey Letter .....	7	14	17,517
University Farm Radio Shorts .....	52	156	3,484
University Farm Shorts .....	12	24	2,758
Visual Aids Tip Sheets .....	11	22	2,926
	173	642	151,589

#### Boys' and Girls' Club Bulletin Series

8. (Revised) 4-H bread. Carol Sanstead and Ina Rowe, Agricultural Extension. 24 pages, 10,000.

31. (Revised and reprinted) 4-H clothing project. Gwen Malum and Athelene Scheid, Agricultural Extension. 40 pages, 40,000.

#### SCIENTIFIC JOURNAL SERIES PAPERS

##### Agricultural Biochemistry

2312. Effect of heat treatment of separated milk on the physical and baking properties of doughs enriched with dry milk solids. R. A. Larson, Robert Jenness, and W. F. Geddes. *Cereal Chemistry* 26:189-200. 1949.

2423. The effect of fat on calcium and phosphorus metabolism in normal growing rats under a normal dietary regime. Charles E. Calverley and Cornelia Kennedy. *Journal of Nutrition* 38:165-175. 1949.

2427. The chemistry of the living bark of the black locust tree in relation to frost hardiness. II. Seasonal variations in the electrophoresis patterns of the water-soluble proteins of the bark. D. R. Briggs and D. Siminovitch. *Archives of Biochemistry* 23:18-28. 1949.

2428. The chemistry of the living bark of the black locust tree in relation to frost hardiness. I. Seasonal variations in protein content. D. Siminovitch and D. R. Briggs. *Archives of Biochemistry* 23:8-17. 1949.

2468. The effect of heat treatment on the sulfhydryl groups of milk serum proteins. Robert A. Larsen, Robert Jenness, and W. F. Geddes. *Cereal Chemistry* 26:287-297. 1949.

2476. The inhibition of the succinoxidase system by  $\alpha$ -tocopheryl phosphate and sodium dedecyl sulfate. M. Rabinovitz and Paul D. Boyer. *The Journal of Biological Chemistry* 183:111-121. 1950.

2480. Chemical and biological studies related to the metabolic function of vitamin E. Paul D. Boyer. *Annals of the New York Academy of Sciences* 52(3):188-194. 1949.

2487. Relation between the amylase activities of malted wheats and malted wheat flours. W. F. Geddes and P. P. Merritt. *Cereal Chemistry* 26:398-404. 1949.

2488. The effect of wheat class and germination moisture and time on the malt yield and amylase activity of malted wheat. J. G. Dickson and W. F. Geddes. *Cereal Chemistry* 26:404-414. 1949.

2489. Effect of wheat class and malting conditions on gassing-power stimulation and alpha- and beta-amylase activities on malted wheat. W. F. Geddes, J. G. Dickson, and C. B. Croston. *Cereal Chemistry* 26:414-418. 1949.

2498. Solubilization in swollen micelles. H. B. Klevens. *The Journal of Chemical Physics* 17:1004. 1949.

2499. Electrophoretic analysis of protein interaction. I. The interaction of bovine serum albumin and methyl orange. Robert F. Smith and D. R. Briggs. *The Journal of Physical and Colloid Chemistry* 54:33-47. 1950.

2500. Studies on bread staling. IV. Evaluation of methods for the measurement of changes which occur during bread staling. C. W. Bice and W. F. Geddes. *Cereal Chemistry* 26:440-465. 1949.

2514. Nutritional value of plant materials. II. Prevention of acute uremia of the newborn rat by vitamin B<sub>12</sub>. M. O. Schultze. *Proceedings of the Society for Experimental Biology and Medicine* 72:613-616. 1949.

2515. Nutritional value of plant materials. I. Growth of rats on purified rations containing soybean protein. M. O. Schultze. *Journal of Nutrition* 41:103-114. 1950.

2529. An electrophoretic analysis of soybean protein. D. R. Briggs and Robert L. Mann. *Cereal Chemistry* 27:243-257. 1950.

2530. Effects of solvent and heat treatments on soybean proteins as evidenced by electrophoretic analysis. Robert L. Mann and D. R. Briggs. *Cereal Chemistry* 27:258-269. 1950.

2533. Solubilization of polycyclic hydrocarbons. H. B. Klevens. *The Journal of Physical and Colloid Chemistry* 54:283-298. 1950.

#### Agricultural Engineering

2442. A regional program for testing weed-control equipment. V. H. Johnson, R. E. Larson, and R. A. Norton. *Journal of American Society of Agricultural Engineers* 30:528-530. November, 1949.

2493. Palatability of beef stored at 0° F. as affected by moisture loss and oxygen availability. Andrew Hustrulid, M. P. Steinberg, and J. D. Winter. *Food Technology* 3(11):367-369. 1949.

#### Agronomy and Plant Genetics

2454. A comparison of combining ability in F<sub>2</sub> and F<sub>3</sub> lines of corn. K. T. Payne and H. K. Hayes. *Agronomy Journal* 41:383-388. 1949.

2463. The effect of flax stand on yields of flaxseed, flax straw, and weeds. R. G. Robinson. *Agronomy Journal* 41:483-484. 1949.

2469. Annual weeds, their viable seed population in the soil, and their effect on yields of oats, wheat, and flax. R. G. Robinson. *Agronomy Journal* 41:513-518. 1949.

2475. Chromosome segregation in maize translocations in relation to crossing over in interstitial segments. C. R. Burnham. *Proceedings of the National Academy of Science* 35:349-356. 1949.

2482. Genetic and environmental factors affecting corn seed germination at low temperatures. Emmett L. Pinnell. *Agronomy Journal* 41:562-568. 1949.

2484. Cytogenetic studies of an inversion in maize. W. A. Russell and C. R. Burnham. *Scientific Agriculture* 30:93-111. 1950.

2485. Studies of inheritance in crosses between Landhafer, *Avena byzantina* L., and two selections of *A. sativa* L. W. R. Kehr and H. K. Hayes. *Agronomy Journal* 42:71-78. 1950.

2490. Correlation studies of yield and other characters in rye polycrosses. F. S. Warren and H. K. Hayes. *Scientific Agriculture* 30:12-29. 1950.

2501. A sprayer for experimental plots. R. G. Robinson and R. S. Dunham. *Agronomy Journal* 42:57-58. 1950.

2510. A study of the relationship of chromosome knobs with certain agronomic and morphologic characters in corn inbreds. Moti V. Vachhani. *Agronomy Journal* 42:196-201. 1950.

2516. The present status of breeding rust resistant oats at the Minnesota Station. W. R. Kehr, H. K. Hayes, M. B. Moore, and E. C. Stakman. *Agronomy Journal* 42:356-359. 1950.

2548. Chlorophyll studies on barley mutants. Harry R. Highkin. *Plant Physiology* 25:294-306. 1950.

#### Dairy Husbandry

2506. The action of microorganisms on fats. I. Oxygen uptake by bacteria in the presence of lipid substrates. J. J. Jezeski, H. O. Halvorson, and H. Macy. *Journal of Bacteriology* 59(5):645-658. May, 1950.

2527. Importance of hay quality as indicated by feeding trials with identical twin dairy heifers. C. N. Kelkar and T. W. Gullickson. *Journal of Dairy Science* 33:288-292. 1950.

#### Entomology and Economic Zoology

2424. Studies on arthropod cuticle. IV. An electron microscope survey of arthropod tracheae. A. Glenn Richards and Frances H. Korda. *Annals of the Entomological Society of America* 43:49-71. 1950.

2430. The fungus (*Haplosporangium parvum*) in the lungs of the beaver (*Castor canadensis*). Arnold B. Erickson. *Journal of Wildlife Management* 13:419-422. 1949.

2452. Contributions towards a monograph of the Mutillidae of the neotropical region. III. A key to the subfamilies represented and descriptions of several new genera. Rudolf M. Schuster. *Entomologica Americana* 39:59-140. 1949.

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2458. Chemical treatment of corn seed for control of the Carabid, *Agonoderus compta*. Donald R. Johnson. *Journal of Economic Entomology* 42:801-805. 1949.



2474. Notes on the morphology and life cycle of the genus *Monoecocestus* Beddard, 1914 (Cestoda: Anoplocephalidae) from the porcupine. Reino S. Freeman. *Journal of Parasitology* 35:605-612. 1949.

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2478. Biological and ecological studies on some lepidopterous bud and shoot insects of jack pine (Lepidoptera-Olethreutidae). James W. Butcher and A. C. Hodson. *Canadian Entomologist* 81:161-173. 1949.

2481. A new bait trap collection record for *Rhagoletis completa* Cress. D. M. Benjamin and A. C. Hodson. *Journal of Economic Entomology* 42:707. 1949.

2534. Woodcock studies at Cloquet Forest Experiment Station, Minnesota. Edgar W. Dangler and William H. Marshall. *The Flicker* 22(1):1-7. 1950.

2540. A preliminary histological study of the insemination reaction in *Drosophila gibberosa*. Helen Tsui-Ying Lee. *Biological Bulletin* 98:25-33. 1950.

#### Forestry

2457. Hydrogen bonding and the swelling of wood in various organic liquids. A. N. Nayer and R. L. Hossfeld. *Journal of the American Chemical Society* 71:2852-2855. August, 1949.

#### Home Economics

2473. Chemical changes in wool resulting from wear and dry cleaning. Ethel L. Phelps, Lillian O. Lund, and Helen W. Norton. *American Dyestuff Reporter* 39(6):177-180. March 20, 1950.

#### Horticulture

2460. Ascorbic acid content of 25 varieties of the rutabaga (*Brassica napobrassic*). R. E. Nylund. *Proceedings of the American Society for Horticultural Science* 54:367-372. 1949.

2465. The cold resistance of certain species of herbaceous perennials. V. L. Clark, W. G. Brierley, L. E. Longley, and R. H. Landon. *Proceedings of the American Society for Horticultural Science* 54:469-472. 1949.

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2535. Inheritance of earliness and fruit size components in a tomato cross. H. W. Fogle and T. M. Currence. *Genetics* 35:363-380. 1950.

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#### Plant Pathology and Botany

2189. *Selenophoma bromigena* leaf spot on *Bromus inermis*. J. Lewis Allison. *Phytopathology* 35:233-240. 1945.

2284. The control of brown rot of stone fruits in field and storage. E. G. Sharvelle and Morris N. Teller. *Phytopathology* 40:776-777. August, 1950.

2467. Numbers, kinds, and source of molds in flour. C. M. Christensen and Mortimer Cohen. *Cereal Chemistry* 27:178-185. 1950.

2483. Damping off of alfalfa cuttings caused by *Rhizoctonia solani*. M. F. Kernkamp, J. W. Gibler, and L. J. Elling. *Phytopathology* 39:928-935. November, 1949.

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2494. The relation of the bluegrass bill bug, *Calendra parvula* (Gyllenhal) to development of basal stem rot and root rot of cereals and grasses in North Central United States. E. W. Hanson, H. E. Milliron, and J. J. Christensen. *Phytopathology* 40:527-543. June, 1950.

2509. Physiologic races of *Puccinia graminis tritici* in Mexico. E. C. Stakman and W. Q. Loegering. Published in Spanish—Razas Fisiologicas de *Puccinia Graminis Tritici* en Mexico. E. C. Stakman, W. Q. Loegering, J. G. Harrar, y N. E. Borlaug, Oficina de Estudios Expeciales, Secretaria de Agricultura y Ganaderia, Mexico, D. F. *Folleto Technico* (3):1-19. April de 1950.

2516. The present status of breeding rust resistant oats at the Minnesota Station. W. R. Kehr, H. K. Hayes, M. B. Moore, and E. C. Stakman. *Agronomy Journal* 42:356-359. July, 1950.

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#### Poultry Husbandry

2470. Self selection of diet by chicks. I. Choice of mash and grain (abstract). G. M. Briggs, M. H. Swanson, E. G. Hill, and H. J. Sloan. *Poultry Science* 28:758. 1949.



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#### Soils

2410. Effect of fertilizers on the composition of potatoes grown in the Red River Valley of Minnesota. L. E. Dunn and C. O. Rost. *Proceedings of the Soil Science Society of America* 13:374-380. 1948.

2422. Factors affecting the nitrate-producing power of some Minnesota soils. A. R. Halvorson and A. C. Caldwell. *Proceedings of the Soil Science Society of America* 13:258-260. 1948.

#### Veterinary Medicine

2462. Histomoniasis (enterohepatitis) in turkeys. II. Chemotherapy of experimental histomoniasis. J. H. Sautter, B. S. Pomeroy, and Martin H. Roepke. *American Journal of Veterinary Research* 11:120-129. 1950.

2464. Histomoniasis (enterohepatitis) in turkeys. I. A procedure for the screening and testing of drugs. J. H. Sautter, B. S. Pomeroy, and Martin H. Roepke. *American Journal of Veterinary Research* 11:115-119. 1950.

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2502. A rapid whole blood plate test for the diagnosis of Newcastle disease. S. L. Zargar and B. S. Pomeroy. *Journal of the American Veterinary Medical Association* 115:354-355. 1949.

2505. Isolation of Newcastle disease virus from commercial fowlpox and laryngotracheitis vaccines. S. L. Zargar and B. S. Pomeroy. *Journal of the American Veterinary Medical Association* 116:304-305. 1950.

2512. The ring test as an aid in the control of Bang's disease. Martin H. Roepke. *Milk Industry Foundation Convention Proceedings, Milk Supply Section* pp. 5-10. October 24-26, 1949.

2513. Vitamin D intake and susceptibility of mice to experimental swine influenza virus infection. George A. Young, Norman R. Underdahl, and Lawrence E. Carpenter. *Proceedings of the Society for Experimental Biology and Medicine* 72:695-697. 1949.

2543. Sulfonamides in poultry diseases. B. S. Pomeroy. *Southwestern Veterinarian* 3:18-22. 1950.

2547. Myoclonia congenita: a disease of newborn pigs. H. C. H. Kernkamp. *Veterinary Medicine* 45:189-190. 1950.

#### MISCELLANEOUS JOURNAL SERIES PAPERS

##### Agricultural Biochemistry

569. Tendances dans l'évolution de la mouture du ble. C. H. Bailey. *Bulletin de l'École de la Meunerie Belge 9<sup>e</sup> Année (1-3)*:1-5. Janvier-Mars, 1947.

##### Agricultural Economics

671. Foreign trade policy—which way. O. B. Jesness. *Journal of Farm Economics* 31(4):814-824. November, 1949.

##### Agronomy and Plant Genetics

670. Minnesota increases seed for new clover varieties. Carl Borgeson. *What's New in Crops and Soils* 2(5):27. 1950.

673. Weed control in soybeans. R. G. Robinson. *Soybean Digest* 9(11):64-65, 75. 1949.

680. Response of flax varieties to 2,4-D and methoxone. R. S. Dunham and R. G. Robinson. *Sixth Annual North Central Weed Control Conference Research Report* p. 83. 1949.

681. Effect of TCA on flax and its residual effect on the following soybean crop. R. G. Robinson and R. S. Dunham. *Sixth Annual North Central Weed Control Conference Research Report* p. 89. 1949.

682. Effect of TCA on quack grass and crops. R. S. Dunham and R. G. Robinson. *Sixth Annual North Central Weed Control Conference Research Report* pp. 203-204. 1949.

683. TCA for weed control. R. S. Dunham. *Proceedings of the Northwest Crop Improvement Association Extension Conference* pp. 11-13. 1949.

684. Effect of 2,4-D and methoxone on flax with and without weeds. R. S. Dunham and R. G. Robinson. *Sixth Annual North Central Weed Control Conference Research Report* p. 83. 1949.

685. Project III. Effects of herbicides in growing crops. R. G. Robinson. *Sixth Annual North Central Weed Control Conference Research Report* pp. 78-79. 1949.

686. Effects of 2,4-D and other herbicides on flax. R. G. Robinson. *Proceedings of the Sixth Annual Meeting of the North Central Weed Control Conference* pp. 70-71. 1949.

690. A mechanical method of dehulling small samples of oats. William R. Kehr. *Agronomy Journal* 42:210. 1950.

##### Entomology and Economic Zoology

658. Packages vs. over-wintered colonies. M. H. Haydak. *American Bee Journal* 90:115-116. 1950.

697. The queen honeybee. M. H. Haydak. *State Apiarist Report of 1949* pp. 68-94. 1949.

## Forestry

664. Development of collapse in aspen lumber. V. H. Clausen, L. W. Rees, and F. H. Kaufert. *Proceedings of the Forest Products Research Society* 3:460-468. 1949.

674. A comparison of the effects of 2,4-D, 2,4,5-T and stoddard solvent sprays on seedlings of black locust (*Robinia pseudoacacia* L.). Henry L. Hansen and John F. Pelton. *Sixth Annual North Central Weed Control Conference Research Report* pp. 141-142. December, 1949.

678. Use of 2,4-D in the eradication of poison ivy (*Rhus radicans* var. *Rydbergii*). Henry L. Hansen. *Sixth Annual North Central Weed Control Conference Research Report* pp. 144-145. December, 1949.

679. The effects of 2,4-D sprays on eastern white pine (*Pinus strobus* L.) seedlings growing under hazelbrush. Henry L. Hansen. *Sixth Annual North Central Weed Control Conference Research Report* p. 142. December, 1949.

687. A twelve-month spray schedule for killing woody plants in northern pastures and woodlots. Henry L. Hansen. *Proceedings of the Sixth Annual Meeting of the North Central Weed Control Conference* pp. 56-58. December, 1949.

688. Developments and trends in forest products research. F. H. Kaufert. *Journal of Forestry* 48(1):18-20. January, 1950.

689. Woody plant control by means of herbicides (abstract). Henry L. Hansen. *Aircraft Spraying and Dusting Short Course* p. 51. November, 1949.

701. Minnesota farmers spend one week each year fencing. J. R. Neetzel and S. A. Engene. *Minnesota Farm and Home Science* VII(1):11: October, 1949.

## Horticulture

636. A study on the control of weeds in beets, onions, and carrots by pre-emergence application of herbicides. R. E. Nylund. *Fifth Annual North Central Weed Control Conference Research Report*. Springfield, Illinois. December 8-10, 1948.

675. A study on the use of 2,4-D for weed control in strawberries. R. E. Nylund. *Sixth Annual North Central Weed Control Conference Research Report* pp. 135-136. December 6, 7, 8, 1949.

676. A study in the use of 2,4-D and methoxone for the control of weeds in Irish potatoes. R. E. Nylund. *Sixth Annual North Central Weed Control Conference Research Report* p. 132. December 6, 7, 8, 1949.

677. A study in the control of weeds in onions by pre-emergence application of herbicides. R. E. Nylund. *Sixth Annual North Central Weed Control Conference Research Report* p. 132. December 6, 7, 8, 1949.

692. Wrapping materials for frozen foods. J. D. Winter. *Scientific Monthly* LXXI(1):61-64. July, 1950.

695. Thinning apples with blossom sprays. W. G. Brierley and W. H. Alderman. *Minnesota Horticulturist* 78:52-53. 1950.

699. Weed control in strawberries with 2,4-D. R. E. Nylund. *Minnesota Horticulturist* 78:71. May, 1950.

## Plant Pathology and Botany

655. The value of copper fungicides for the control of strawberry leaf spot. E. G. Sharvelle and M. N. Teller. *Phytopathology* 40:777-778. August, 1950.

669. Root rot of soybeans. M. F. Kernkamp. *The Soybean Digest* 9:54-55. 1950.

704. Seed treatment of alfalfa, red clover and sweet clover. M. F. Kernkamp. *Minnesota Seed Grower* 23:1. June, 1950.

## Rural Sociology

666. The decline in farm family fertility and its relationship to nationality and religious background. Douglas G. Marshall. *Rural Sociology* 15(1):42-49. March, 1950.

## Soils

660. Fertilizing oats and new seedings in Minnesota. E. R. Duncan. *What's New in Crops and Soils* 2(3):18-20. December, 1949.

## Veterinary Medicine

657. Clinical diagnosis of brucellosis in swine. H. C. H. Kernkamp. *Veterinary Medicine* 44:389-392. 1949.

691. The treatment of retained fetal membranes and their sequelae in the bovine. W. L. Boyd. *Veterinary Medicine* 45:263. 1950.

694. Influenza in swine. George A. Young. *Veterinary Medicine* 45:141-146. 1950.

SUMMARY OF PUBLICATIONS  
July 1949—June 1950

Kind of Publication	Number issued	Number of pages	Number of copies in edition
General Series Bulletins .....	3	54	22,000
Technical Series Bulletins .....	7	316	23,000
Minnesota Farm and Home Science .....	3	52	49,050
Report Series .....	3	68	20,000
Extension Service			
Bulletins .....	9	200	130,000
Pamphlets .....	6	40	69,500
Folders .....	8	60	145,000
4-H Bulletins .....	2	64	50,000
Newsletters .....	173	642	151,589
	214	1,496	660,139

SUMMARY OF JOURNAL SERIES PAPERS

Division	Scientific Journal Series		Miscellaneous Journal Series	
	Number issued	Number of pages	Number issued	Number of pages
Agricultural Biochemistry .....	18	197	1	5
Agricultural Economics .....	0	0	1	11
Agricultural Engineering .....	2	6	0	0
Agronomy and Plant Genetics .....	12	99	10	17
Animal Husbandry .....	0	0	0	0
Dairy Husbandry .....	2	19	0	0
Entomology and Economic Zoology .....	11	164	2	29
Forestry .....	1	4	8	22
Home Economics .....	1	4	0	0
Horticulture .....	6	43	7	12
Plant Pathology and Botany .....	10	85	3	5
Poultry Husbandry .....	2	3	0	0
Rural Sociology .....	0	0	1	8
Soils .....	2	10	1	3
Veterinary Medicine .....	9	42	3	12
	76	676	37	124
Total Publications .....	113			

NEW EXPERIMENT STATION PROJECTS

Agricultural Biochemistry

204. The chemistry of milk as a colloidal system.  
205. The relation of nutrients to metabolic processes.  
FH-2215-2. Planning cooperative research on animal nutrition and physiology.

Agricultural Economics

147. Adjustments in Red River Valley agriculture to mechanization and new techniques in production.  
FH-2211-4. A study of problems of land economics, including ownership, land prices, inheritance, and classification.  
FH-2211-M5. Measurement of costs and margins in marketing farm products through public eating places.  
FH-2211-M6. The economics of storage.

Agricultural Engineering

- 111-4. Investigation of farm buildings. (4) Development of new designs for farm buildings and equipment.  
FH-2221-M1. Studies on harvesting, handling, storage, and marketing of table stock potatoes. (See also Horticulture FH-2221-M1.)

Agronomy and Plant Genetics

120. Crop sequences.

Animal Husbandry

435. The effects of different levels of feeding upon the economy of gains of growing-fattening pigs and the characteristics of the carcasses.  
436. Increasing the intake of iron and copper in rations for growing pigs.  
437. A study of DDT and methoxychlor for the control of flies on beef cattle.

Dairy Husbandry

219. The effects of inheritance, management, and environment on dairy cattle as determined by the use of identical twins.  
220. Feeding value of crops when harvested as hay, silage, and pasture.  
221. A study of milk formation by the use of radioactive carbon compounds.  
FH-2216-2. Inheritance in dairy cattle.

## Entomology and Economic Zoology

165. Study of movements, reproduction, and survival of beaver.

166. Honeybee diseases and their control.

FH-2217-2. The toxicity to European corn borer of insecticides and an interpretation of their penetration and accumulation in insect cuticle.

FH-2217-3. Insects affecting alfalfa and clover seed production.

## Home Economics

120. The thermal transmission of wool clothing fabrics before and after wear and dry cleaning.

121. The conservation of the nutritive value in rutabagas and turnips.

122. Effect of storage and cooking on the reduced ascorbic acid, dehydroascorbic acid, diketogulonic acid, and reductone contents of potatoes.

## Horticulture

10. Potato breeding.

11. Potato varietal studies.

FH-2221-M1. Studies on harvesting, handling, storage, and marketing of table stock potatoes. (See also Agricultural Engineering FH-2221-M1.

NC-7 Minn. 2. Introduction, preservation, and evaluation of stone fruits of probable potential value to the North Central Region.

## Plant Pathology and Botany

127. Physiological and ecological studies on crop plants.

8275. The effects of radioactive substances on plant pathogens and other microorganisms.

## Poultry Husbandry

509. Brewer's yeast in poultry nutrition.

## Veterinary Medicine

NC-13. Death losses in young pigs.

## SUMMARY OF PROJECTS

Division	Total	Active	Inactive	Closed	New
Agricultural Biochemistry .....	18	17	1	3	3
Agricultural Economics .....	30	30	0	0	4
Agricultural Engineering .....	20	20	0	4	2
Agronomy and Plant Genetics .....	23	23	0	4	1
Animal Husbandry .....	15	15	0	2	3
Dairy Husbandry .....	16	16	0	4	4
Entomology and Economic Zoology .....	22	21	1	4	4
Forestry .....	10	10	0	0	0
Home Economics .....	14	14	0	3	3
Horticulture .....	21	21	0	3	4
Plant Pathology and Botany .....	25	25	0	8	2
Poultry Husbandry .....	9	9	0	0	1
Rural Sociology .....	5	5	0	1	0
Soils .....	12	12	0	0	0
Veterinary Medicine .....	9	9	0	2	1
North Central Experiment Station .....	4	4	0	0	0
Northeast Experiment Station .....	6	6	0	0	0
Northwest Experiment Station .....	6	6	0	0	0
Southeast Experiment Station .....	2	2	0	0	0
West Central Experiment Station .....	6	6	0	0	0
<b>Total</b> .....	<b>273</b>	<b>271</b>	<b>2</b>	<b>38</b>	<b>32</b>

**FINANCIAL STATEMENT**  
Income 1949-1950

Sources of Revenue	University Farm	Branch Stations					Total
		Crookston	Morris	Grand Rapids	Duluth	Waseca	
<b>Federal appropriations:</b>							
Hatch fund .....	\$ 15,000.00						\$ 15,000.00
Adams fund .....	15,000.00						15,000.00
Purnell fund .....	60,000.00						60,000.00
Bankhead-Jones fund .....	66,813.91						66,813.91
Research and Marketing fund .....	124,391.56						124,391.56
Regional Research fund .....	36,266.12						36,266.12
<b>State appropriations:</b>							
General University support .....	714,389.86	\$52,959.28	\$59,134.27	\$40,830.65	\$29,633.80	\$21,250.21	918,198.07
Special appropriations .....	248,000.00						248,000.00
<b>Endowments, fellowships, and other similar grants</b>							
.....	108,208.65						108,208.65
<b>Fees, sales, and miscellaneous</b>							
.....	164,201.19	29,261.94	28,149.11	14,049.16	15,549.89	55,630.59	306,841.88
<b>Total</b> .....	<b>\$1,552,271.29</b>	<b>\$82,221.22</b>	<b>\$87,283.38</b>	<b>\$54,879.81</b>	<b>\$45,183.69</b>	<b>\$76,880.80</b>	<b>\$1,898,720.19</b>

**EXPENDITURES 1949-1950**

Classification	University Farm	Branch Stations					Total
		Crookston	Morris	Grand Rapids	Duluth	Waseca	
Services and labor .....	\$1,032,398.20	\$56,499.49	\$63,638.88	\$36,501.64	\$30,455.14	\$51,021.24	\$1,270,514.59
Travel expenses .....	31,700.40	612.45	853.45	365.30	523.14	301.57	34,356.31
Transportation of things .....	5,212.90	340.75	401.64	495.89	91.00	179.18	6,721.36
Communication service .....	7,498.77	548.12	466.43	283.91	355.13	267.52	9,419.88
Rents and utility service .....	16,856.98	2,444.19	1,112.73	1,329.67	1,197.47	1,117.14	24,058.18
Printing and binding .....	5,082.26		41.31				5,123.57
Other contractual services .....	97,886.58	5,444.80	1,128.81	3,346.26	3,572.85	4,525.65	115,904.95
Supplies and materials .....	225,770.51	13,523.16	14,436.32	11,539.34	7,597.93	17,759.61	290,626.87
Equipment .....	69,887.38	2,162.50	3,776.34	1,017.80	1,391.03	1,208.89	79,443.94
Lands and structures (contractual) .....	11,821.97	645.76	1,427.47			500.00	14,395.20
Annuities .....	1,582.62						1,582.62
Balance brought forward for R.M. and R.R.F. funds .....	46,572.72						46,572.72
<b>Total</b> .....	<b>\$1,552,271.29</b>	<b>\$82,221.22</b>	<b>\$87,283.38</b>	<b>\$54,879.81</b>	<b>\$45,183.69</b>	<b>\$76,880.80</b>	<b>\$1,898,720.19</b>



## EXPERIMENT STATION STAFF

## The Board of Regents

THE HON. JAMES F. BELL, Minneapolis	-	-	-	-	-	1951
THE HON. DANIEL C. GAINNEY, Owatonna	-	-	-	-	-	1955
THE HON. RICHARD L. GRIGGS, Duluth	-	-	-	-	-	1951
THE HON. J. S. JONES, St. Paul	-	-	-	-	-	1953
THE HON. GEORGE W. LAWSON, St. Paul	-	-	-	-	-	1951
THE HON. A. J. LOBB, Rochester	-	-	-	-	-	1953
THE HON. E. E. NOVAK, New Prague	-	-	-	-	-	1955
THE HON. A. J. OLSON, Renville	-	-	-	-	-	1955
THE HON. RAY J. QUINLIVAN, St. Cloud	-	-	-	-	-	1951
THE HON. HERMAN F. SKYBERG, Fisher	-	-	-	-	-	1955
THE HON. FRED B. SNYDER, Minneapolis	-	-	-	-	-	1953
THE HON. SHELDON V. WOOD, Minneapolis	-	-	-	-	-	1953

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O. B. JESNESS, Ph.D., Chief, Division of Agricultural Economics
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E. F. FERRIN, M.Agr., Chief, Division of Animal Husbandry
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WYLLE B. McNEAL, M.A., Director, School of Home Economics
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H. J. SLOAN, Ph.D., Chief, Division of Poultry Husbandry
C. O. ROST, Ph.D., Chief, Division of Soils
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D. L. DAILEY, B.S., Superintendent, North Central Experiment Station, Grand Rapids
M. J. THOMPSON, M.S., Superintendent, Northeast Experiment Station, Duluth
T. M. McCALL, M.S., Superintendent, Northwest Experiment Station, Crookston
R. E. HODGSON, M.S., Superintendent, Southeast Experiment Station, Waseca
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T. SCHANTZ-HANSEN, Ph.D., Director, Forestry and Biological Station, Itasca Park

H. B. SWANSON, M.S., Bulletin Editor  
 E. W. McDIARMID, Ph.D., Librarian  
 HARALD OSTVOLD, B.S., Agricultural Librarian

## DIVISION OF AGRICULTURAL BIOCHEMISTRY

W. F. GEDDES, Ph.D., Agricultural Biochemist, Chief

## Section of Colloids, Carbohydrates, and Proteins

D. R. BRIGGS, Ph.D., Agricultural Biochemist  
 \*W. M. SANDSTROM, Ph.D., Agricultural Biochemist  
 FRED SMITH, B.Sc., Ph.D., D.Sc., Agricultural Biochemist  
 D. SIMINOVITCH, Ph.D., Research Fellow

## Section of Cereal Technology

C. H. BAILEY, Ph.D., Agricultural Biochemist  
 W. F. GEDDES, Ph.D., Agricultural Biochemist  
 \*R. A. BOTTOMLEY, Ph.D., Assistant Biochemist  
 \*C. W. BICE, Ph.D., Research Fellow  
 \*B. M. CRAIG, Ph.D., Research Fellow  
 \*R. J. STENBERG, Ph.D., Research Fellow

## Section of Nutrition, Dairy Chemistry, and Analytical Service

M. O. SCHULTZE, Ph.D., Agricultural Biochemist  
 P. D. BOYER, Ph.D., Associate Agricultural Biochemist  
 ROBERT JENNESS, Ph.D., Associate Agricultural Biochemist  
 \*I. E. LIENER, Ph.D., Assistant in Agricultural Biochemistry

## DIVISION OF AGRICULTURAL ECONOMICS

O. B. JESNESS, Ph.D., Agricultural Economist, Chief  
 A. A. DOWELL, Ph.D., Agricultural Economist  
 E. F. KOLLER, Ph.D., Agricultural Economist  
 G. A. POND, Ph.D., Agricultural Economist  
 W. C. WAITE, Ph.D., Agricultural Economist  
 R. W. COX, Ph.D., Associate Agricultural Economist  
 S. A. ENGELMAN, Ph.D., Associate Agricultural Economist  
 G. ENGELMAN, Ph.D., Research Associate  
 TRUMAN R. NODLAND, Ph.D., Assistant Agricultural Economist  
 \*TRAVIS R. MANNING, M.S., Research Fellow  
 W. E. McDANIEL, M.S., Assistant in Agricultural Economics  
 F. R. TAYLOR, M.S., Assistant in Agricultural Economics

## DIVISION OF AGRICULTURAL ENGINEERING

\*A. J. SCHWANTES, M.S., Agricultural Engineer, Chief

<sup>1</sup> On leave November 21, 1949, to December 31, 1949; April 17, 1950, to May 15, 1950  
<sup>2</sup> Resigned September 20, 1949  
<sup>3</sup> Resigned January 31, 1950  
<sup>4</sup> Resigned May 31, 1950  
<sup>5</sup> Resigned June 30, 1950  
<sup>6</sup> Appointed July 1, 1949  
<sup>7</sup> Appointed February 6, 1950  
<sup>8</sup> On leave July 1, 1949, to September 30, 1949

## Section of Farm Power and Machinery

A. J. SCHWANTES, M.S., Agricultural Engineer  
 JOHN STRAIT, M.S., Assistant Agricultural Engineer  
 J. B. TORRANCE, B.S., Assistant Agricultural Engineer  
 J. G. DENT, Assistant in Agricultural Engineering  
 V. H. JOHNSON, B.A.E., Assistant in Agricultural Engineering

## Section of Farm Structures

C. K. OTIS, M.S., Agricultural Engineer  
 C. H. CHRISTOPHERSON, M.A., Associate Agricultural Engineer  
 A. H. BURMAN, B.S., Assistant in Agricultural Engineering  
 \*W. F. MILLER, Ph.D., Research Fellow

## Section of Agricultural Physics and Rural Electrification

ANDREW HUSTRULID, Ph.D., Agricultural Engineer  
 A. M. FLIKKE, M.S., Assistant Agricultural Engineer  
 \*A. G. TYLER, B.S., Assistant Agricultural Engineer

## Section of Soil and Water Conservation

P. W. MANSON, M.S., Agricultural Engineer  
 E. R. ALLRED, M.S., Assistant Agricultural Engineer  
 C. L. LARSON, M.S., Assistant in Agricultural Engineering

## Section of Land Clearing

M. J. THOMPSON, M.S., Land Clearing Specialist

Detailed by the Public Roads Administration of Federal Works Agency, for  
 Cooperative Work

\*\*D. G. MILLER, C. E., Materials Engineer

Detailed by the United States Department of Agriculture, Bureau of Plant Industry,  
 Soils, and Agricultural Engineering, Division of Farm  
 Machinery, for Cooperative Work

R. E. LARSON, B.A.E., Assistant Agricultural Engineer

## DIVISION OF AGRONOMY AND PLANT GENETICS

H. K. HAYES, D.Sc., Agronomist and Plant Geneticist, Chief  
 C. R. BURNHAM, Ph.D., Agronomist and Plant Geneticist  
 R. S. DUNHAM, M.S., Agronomist and Plant Geneticist  
 E. H. RINKE, Ph.D., Agronomist and Plant Geneticist  
 R. F. CRIM, B.S., Associate Agronomist and Associate Plant Geneticist  
 J. W. LAMBERT, Ph.D., Associate Agronomist and Associate Plant Geneticist  
 A. R. SCHMID, Ph.D., Associate Agronomist and Associate Plant Geneticist  
 H. L. THOMAS, Ph.D., Associate Agronomist and Associate Plant Geneticist  
 CARL BORGESON, M.S., Assistant Agronomist and Assistant Plant Geneticist  
 E. L. PINNELL, Ph.D., Assistant Agronomist and Assistant Plant Geneticist  
 R. G. ROBINSON, Ph.D., Assistant Agronomist and Assistant Plant Geneticist

\* Appointed December 1, 1949

\*\* Retired June 15, 1950

\*\* Retired May 29, 1950

Detailed by the United States Department of Agriculture, Bureau of Plant Industry,  
 Soils, and Agricultural Engineering, Division of Cereal Crops  
 and Diseases, for Cooperative Work

E. R. AUSEMUS, Ph.D., Agronomist  
 J. O. CULBERTSON, Ph.D., Agronomist  
 J. H. MILLER, M.S., Agent

## DIVISION OF ANIMAL HUSBANDRY

E. F. FERRIN, M.Agr., Animal Husbandman, Chief  
 \*\*W. H. PETERS, M.Agr., Animal Husbandman, Chief  
 A. L. HARVEY, Ph.D., Animal Husbandman  
 P. A. ANDERSON, B.S., Associate Animal Husbandman  
 R. M. ANDERSON, Ph.D., Assistant in Animal Husbandry  
 W. J. AUNAN, M.S., Assistant in Animal Husbandry

## Section of Animal Feeding

E. F. FERRIN, M.Agr., Animal Husbandman

## Section of Animal Breeding

L. M. WINTERS, Ph.D., Animal Husbandman  
 J. N. CUMMINGS, Ph.D., Associate Animal Husbandman  
 \*\*C. F. SIERK, Ph.D., Associate Animal Husbandman  
 \*\*FREDERICK KRISTJANSSEN, M.S., Research Fellow  
 \*\*C. B. ROUBICEK, M.S., Research Fellow

## DIVISION OF DAIRY HUSBANDRY

J. B. FITCH, M.S., Dairy Husbandman, Chief

## Section of Dairy Production

J. B. FITCH, M.S., Dairy Husbandman  
 T. W. GULLICKSON, Ph.D., Dairy Husbandman  
 W. E. PETERSEN, Ph.D., Dairy Husbandman  
 M. C. HERVEY, Ph.D., Associate Dairy Husbandman  
 L. S. MIX, B.S., Research Fellow

## Section of Dairy Products

W. B. COMBS, M.A., Dairy Husbandman  
 S. T. COULTER, Ph.D., Dairy Husbandman  
 H. A. HARLAND, M.S., Research Associate  
 H. A. MORRIS, M.S., Assistant in Dairy Husbandry  
 E. L. THOMAS, M.S., Assistant in Dairy Husbandry

## Section of Dairy Bacteriology

H. MACY, Ph.D., Dairy Bacteriologist  
 J. C. OLSON, JR., Ph.D., Associate Dairy Bacteriologist  
 J. J. JEZESKI, Ph.D., Assistant Dairy Bacteriologist

\*\* Deceased August 8, 1949

\*\* Resigned May 12, 1950

\*\* Resigned September 20, 1949

\*\* Resigned August 1, 1949

## DIVISION OF ENTOMOLOGY AND ECONOMIC ZOOLOGY

C. E. MICKEL, Ph.D., Entomologist, Chief  
 A. A. GRANOVSKY, Ph.D., Entomologist  
 A. C. HOBSON, Ph.D., Entomologist  
 F. G. HOLDAWAY, Ph.D., Entomologist  
 W. H. MARSHALL, Ph.D., Zoologist  
 A. G. RICHARDS, Ph.D., Entomologist  
 H. J. GRIFFITHS, Ph.D., Associate Zoologist  
 M. H. HAYDAK, Ph.D., Associate Apiculturist  
 L. L. SMITH, JR., Ph.D., Associate Zoologist  
 T. L. AAMODT, B.S., Assistant Entomologist  
 JAMES R. BEER, Ph.D., Assistant Zoologist  
<sup>16</sup>A. L. BURROUGHS, Ph.D., Assistant Entomologist  
 L. K. CUTKOMP, Ph.D., Assistant Entomologist  
<sup>17</sup>T. A. GOCHNAUER, Ph.D., Research Associate  
 H. C. CHIANG, Ph.D., Research Fellow  
<sup>18</sup>E. F. COOK, Ph.D., Assistant in Entomology  
 R. S. FREEMAN, M.S., Research Fellow  
 A. G. PETERSON, Ph.D., Research Fellow

## DIVISION OF FORESTRY

F. H. KAUFERT, Ph.D., Forester, Director  
 J. H. ALLISON, Ph.B., M.F., Forester  
 T. SCHANTZ-HANSEN, Ph.D., Forester; Director, Lake Itasca Forestry and Biological Station  
 HENRY SCHMITZ, Ph.D., Forester  
 R. M. BROWN, M.F., Associate Forester  
 H. L. HANSEN, Ph.D., Associate Forester  
 R. L. HOSSFELD, Ph.D., Associate Forester  
 L. W. REES, Ph.D., Associate Forester  
<sup>19</sup>A. E. SCHNEIDER, M.A., Associate Forester  
 J. R. NEETZEL, M.F., Research Associate  
 D. P. DUNCAN, M.S., Assistant in Forestry  
 O. F. HALL, M.F., Assistant in Forestry  
 A. K. KEMP, M.F., Assistant in Forestry

## DIVISION OF HOME ECONOMICS

<sup>20</sup>WYLLE B. MCNEAL, M.A., Home Economist, Director  
 ALICE BIESTER, A.M., Home Economist  
 JANE M. LEICHSENRING, Ph.D., Home Economist  
 ISABEL NOBLE, Ph.D., Home Economist  
 ETHEL PHELPS, M.S., Home Economist  
 DOROTHY F. SIMMONS, M.S., Associate Home Economist  
<sup>21</sup>MARGUERITE L. PAULSEN, M.S., Assistant in Home Economics

<sup>16</sup> On leave July 1, 1949, to June 30, 1950  
<sup>17</sup> Appointed October 1, 1949  
<sup>18</sup> Appointed October 1, 1949  
<sup>19</sup> Appointed September 1, 1949  
<sup>20</sup> Retired June 30, 1950  
<sup>21</sup> Resigned June 15, 1950

## DIVISION OF HORTICULTURE

W. H. ALDERMAN, B.S.A., Horticulturist, Chief; Superintendent, Fruit Breeding Station  
 J. D. WINTER, M.S., Associate Horticulturist

## Section of Pomology

W. G. BRIERLEY, Ph.D., Horticulturist  
 B. F. DUNN, B.S., Research Associate

## Section of Fruit Breeding

T. S. WEIR, M.S., Associate Horticulturist and Assistant Superintendent of Fruit Breeding Station  
 A. N. WILCOX, Ph.D., Associate Horticulturist

## Section of Vegetable Gardening

T. M. CURRENCE, Ph.D., Horticulturist  
 F. A. KRANTZ, Ph.D., Horticulturist  
 A. E. HUTCHINS, Ph.D., Associate Horticulturist  
 R. E. NYLUND, Ph.D., Assistant Horticulturist  
<sup>22</sup>W. A. OITTO, B.S., Research Fellow

## Section of Floriculture and Ornamental Horticulture

R. A. PHILLIPS, M.S., Assistant Horticulturist  
<sup>23</sup>R. E. WIDMER, M.S., Assistant in Horticulture

Detailed by the United States Department of Agriculture, Bureau of Plant Industry, Soils, and Agricultural Engineering, for Cooperative Work

KENNETH W. HANSON, Special Agent  
 FLORIAN I. LAUER, Special Agent  
<sup>24</sup>MARVIN P. STEINBERG, M.S., Special Agent  
<sup>25</sup>O. C. TURNQUIST, M.S., Agent Horticulturist

## DIVISION OF PLANT PATHOLOGY AND BOTANY

E. C. STAKMAN, Ph.D., Plant Pathologist and Botanist, Chief  
 C. M. CHRISTENSEN, Ph.D., Plant Pathologist  
<sup>26</sup>J. J. CHRISTENSEN, Ph.D., Plant Pathologist  
 C. J. EIDE, Ph.D., Plant Pathologist  
 HELEN HART, Ph.D., Plant Pathologist  
 M. F. KERNKAMP, Ph.D., Associate Plant Pathologist  
 L. T. DOSDALL, Ph.D., Assistant Plant Pathologist  
 T. H. KING, Ph.D., Assistant Plant Pathologist  
 R. H. LANDON, Ph.D., Assistant Plant Physiologist  
 A. H. LARSON, B.S., Assistant Botanist  
<sup>27</sup>E. E. BUTLER, M.S., Research Fellow  
<sup>28</sup>J. M. DALY, M.S., Assistant in Plant Pathology

<sup>22</sup> Resigned June 30, 1950  
<sup>23</sup> Appointed July 1, 1949  
<sup>24</sup> Resigned August 31, 1949  
<sup>25</sup> Resigned September 30, 1949  
<sup>26</sup> On leave March 1, 1950, to April 30, 1950; June 1, 1950, to June 30, 1950  
<sup>27</sup> Appointed February 16, 1950  
<sup>28</sup> Resigned December 31, 1949

H. G. HEGGENESS, M.S., Assistant in Plant Pathology  
 THOR KOMMEDAHL, M.S., Assistant in Plant Pathology  
 C. E. LOGSDON, B.A., Research Fellow  
 M. B. MOORE, M.S., Assistant in Plant Pathology

Detailed by the United States Department of Agriculture, Bureau of Plant Industry,  
 Soils, and Agricultural Engineering, for Cooperative Work  
 Division of Cereal Crops and Diseases

M. N. LEVINE, Ph.D., Pathologist

Division of Sugar Plant Investigation  
 C. L. SCHNEIDER, B.S., Assistant Pathologist

Bureau of Entomology and Plant Quarantine  
 Division of Plant Disease Control

R. U. COTTER, Ph.D., Pathologist  
 THAIN H. STEWART, B.S., State Leader of Barberry Eradication  
 W. Q. LOEGERING, Ph.D., Pathologist

Detailed by the State Department of Agriculture, Dairy and Food,  
 for Cooperative Work

A. G. TOLAAS, M.S., In Charge, Office of Seed Potato Certification  
 J. L. LARSON, Seed Analyst in Charge of Seed Germination  
 H. C. REGNIER, Chief Inspector, Office of Seed Potato Certification

#### DIVISION OF POULTRY HUSBANDRY

H. J. SLOAN, Ph.D., Poultry Husbandman, Chief  
 G. M. BRIGGS, Ph.D., Associate Poultry Husbandman  
 T. H. CANFIELD, M.S., Associate Poultry Husbandman  
 R. N. SHOFFNER, Ph.D., Associate Poultry Husbandman

#### DIVISION OF SOILS

C. O. ROST, Ph.D., Soils Chemist, Chief  
 P. M. BURSON, M.S., Soils Chemist  
 P. R. McMILLER, M.S., Soils Chemist  
 A. C. CALDWELL, Ph.D., Associate Soils Chemist  
 J. M. MACGREGOR, Ph.D., Associate Soils Chemist  
 H. F. ARNEMAN, M.S., Assistant in Soils Chemistry

Detailed by the United States Department of Agriculture, Bureau of Plant Industry,  
 Soils, and Agricultural Engineering, Division of Soils,  
 for Cooperative Work

I. J. NYGARD, Ph.D., Senior Soil Scientist and Correlator

Soil Conservation Service

ALEX ROBERTSON, B.S., Collaborator Soil Scientist

#### DIVISION OF VETERINARY MEDICINE

W. L. BOYD, D.V.S., Veterinarian, Chief  
 J. N. CAMPBELL, D.V.S., B.S., Veterinarian  
 R. FENSTERMACHER, D.V.M., Pathologist

ALLAN HEMINGWAY, Ph.D., Biological Chemist  
 H. C. H. KERNKAMP, D.V.M., M.S., Veterinarian  
 B. S. POMEROY, D.V.M., Ph.D., Animal Pathologist  
 M. H. ROEPKE, Ph.D., Biological Chemist  
 H. J. GRIFFITHS, D.V.M., Ph.D., Associate Animal Parasitologist  
<sup>29</sup>R. A. MERRILL, D.V.M., Associate Veterinarian  
 J. H. SAUTER, D.V.M., Ph.D., Associate Veterinarian  
 A. F. SELLERS, D.V.M., Ph.D., Associate Veterinarian  
<sup>30</sup>A. F. WEBER, D.V.M., Ph.D., Assistant Veterinarian  
 D. E. BARTLETT, D.V.M., Assistant in Veterinary Medicine  
<sup>31</sup>C. M. BEMIS, D.V.M., Assistant in Veterinary Medicine  
 R. W. BROWN, V.M.D., B.S., Research Fellow  
<sup>32</sup>T. M. CHRISTISON, B.S., M.A., Assistant in Veterinary Medicine  
<sup>33</sup>G. H. CONNER, D.V.M., M.S., Assistant in Veterinary Medicine  
<sup>34</sup>R. B. ENGLAND, D.V.M., B.S.A., Assistant in Veterinary Medicine  
 W. J. HADLOW, D.V.M., Assistant in Veterinary Medicine  
 H. H. HOYT, D.V.M., Assistant in Veterinary Medicine  
 R. L. KITCHELL, D.V.M., Assistant in Veterinary Medicine  
<sup>35</sup>A. N. KORSUNSKY, V.D., Research Fellow  
<sup>36</sup>W. A. MALMQUIST, D.V.M., Assistant in Veterinary Medicine  
 G. W. MATHER, D.V.M., Assistant in Veterinary Medicine  
<sup>37,38</sup>J. E. MOULTON, D.V.M., B.S., Assistant in Veterinary Medicine  
 T. B. O'DELL, Ph.D., Assistant in Veterinary Medicine  
 W. R. PRITCHARD, D.V.M., Assistant in Veterinary Medicine  
 F. A. SPURRELL, D.V.M., B.S., Assistant in Veterinary Medicine  
<sup>39</sup>C. C. TURBES, D.V.M., M.S., Assistant in Veterinary Medicine  
 J. E. WILLIAMS, D.V.M., M.S., Research Fellow

#### RURAL SOCIOLOGY

<sup>40</sup>LOWRY NELSON, Ph.D., Rural Sociologist  
 DOUGLAS G. MARSHALL, Ph.D., Associate Rural Sociologist

#### AGRICULTURAL EXPERIMENT STATION—ROSEMOUNT

<sup>41</sup>A. C. HEINE, B.S., Superintendent

#### NORTH CENTRAL EXPERIMENT STATION

D. L. DAILEY, B.S., Superintendent  
 RICHARD B. AAKRE, B.S., Assistant Agricultural Engineer  
 C. H. GRIFFITH, M.S., Assistant Agronomist  
 K. P. MILLER, M.S., Assistant Animal Husbandman  
 C. R. OLSEN, B.S., Assistant in Horticulture and Poultry

<sup>29</sup> Appointed January 1, 1950

<sup>30</sup> Appointed August 16, 1949

<sup>31</sup> Appointed July 16, 1949

<sup>32</sup> Appointed July 1, 1949

<sup>33</sup> Resigned June 30, 1950

<sup>34</sup> Appointed September 16, 1949

<sup>35</sup> Appointed October 1, 1949

<sup>36</sup> On leave July 1, 1949, to June 30, 1950

<sup>37</sup> Appointed July 1, 1949

<sup>38</sup> Resigned June 30, 1950

<sup>39</sup> Appointed September 16, 1949

<sup>40</sup> On leave March 16, 1950, to June 15, 1950

<sup>41</sup> Appointed July 16, 1949