The Department of Plant Sciences offers graduate studies leading to the Master of Science (M.S.) degrees in Cereal Science, Plant Sciences, and Horticulture, and to a Doctor of Philosophy (Ph.D.) degree in Cereal Science or Plant Sciences, with an optional program of emphasis in Plant Breeding and Genetics. Specialized academic and research training in Plant Sciences is available in plant breeding and genetics, weed science, biotechnology, and field and forage crop production and management. Areas of specialization in Horticulture include breeding and genetics, biotechnology, physiology, propagation, sports and urban turf grass management, and production and management of horticultural crops such as woody plants, potatoes, vegetables, and herbaceous ornamentals. Areas of specialization in Cereal Science may involve research in the areas of carbohydrates, enzymes, legumes and other northern-grown crops, barley malting and brewing, wheat milling, baking, and pasta processing. Each study area is designed to provide students with comprehension of the discipline and of relevant regional and global-community social issues.

The Department of Plant Sciences is located in Loftsgard Hall, which provides a state-of-the-art facility for interdisciplinary research in plant sciences, ranging from basic studies and biotechnology to the more traditional applied areas. Facilities for cereal science research are located in Harris Hall. These facilities include analytical laboratories for grain quality research, baking, milling, malting and brewing, and pasta and noodle processing. State-of-the-art greenhouses and extensive growth chamber facilities are also available, as are 100 acres of field research land adjacent to the Plant Science Complex. An additional 500 acres of research land are located near the North Dakota State University campus. A horticultural farm only 25 miles west of campus has an extensive arboretum. Excellent supporting disciplines located nearby, or in the Plant Science Complex, include Soil Science, Botany, Biochemistry and Molecular Biology, Entomology, and Plant Pathology. The Department of Plant Sciences encourages interdisciplinary research and students frequently tailor their research program to meet their interests by working with faculty in one or more of the supporting disciplines.

Graduate student numbers per faculty member are limited, so the student gets adequate personal attention and works closely with their adviser in research. Final selection of the adviser will be made on the basis of the student’s interest, availability of space in the researcher’s laboratory, and a common desire of the student and professor to work together.

The Department of Plant Sciences graduate programs are open to all qualified graduates of universities and colleges of recognized standing. To be admitted with full status to the program, the applicant must meet Graduate School and department admission requirements.

**Financial Assistance**

Graduate research assistantships (half-time) are provided on a competitive basis based on scholarship and potential to undertake advanced study and research. The information provided within the application to Graduate School is used to assign available assistantships to applicants. The annual stipend varies based on the research project. In addition to the stipend, graduate assistants who meet the hours worked requirement each semester receive a graduate tuition waiver. Students are responsible for differential tuition, student fees, and tuition for non-graduate level credits taken or Cooperative Education credits.

A limited number of graduate fellowships are available.

The Department of Plant Sciences has numerous annual scholarships of $500 to $1000 each for outstanding Plant Sciences graduate students.
For each M.S. or Ph.D. student, a plan of study that meets disciplinary requirements and the needs of the student will be developed in the first year. The faculty adviser and other members of the student's supervisory and examining committee assist in developing of the plan of study as well as the student's research plan.

**Master's Program**

The M.S. Plan A Thesis Option program requires completion of at least 30 credits, including 10 credits PLSC 798 Master's Thesis. The M.S. Plan B Comprehensive Study Option program requires completion of at least 30 credits, including 3 credits of a PLSC 797 Master's Paper. Both Plan A and Plan B further require an oral examination of academics related to the discipline and the research-based thesis as well as a public Exit Seminar discussing their thesis work. M.S. students generally satisfy all requirements within two years.

<table>
<thead>
<tr>
<th>Code</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>M.S. Plan A - Thesis Option</td>
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<tr>
<td>600-700 level courses including</td>
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<tr>
<td>PLSC 724</td>
<td>Field Design I</td>
<td>3</td>
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<tr>
<td>Didactic graduate courses numbered 600-689 and/or 700-789</td>
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<tr>
<td>Students focusing on Plant Breeding and Genetics must take and earn a B or better in</td>
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<tr>
<td>PLSC 718</td>
<td>Genetics &amp; Plant Improvement</td>
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<tr>
<td>PLSC 731</td>
<td>Plant Molecular Genetics</td>
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<tr>
<td>PLSC 790</td>
<td>Graduate Seminar</td>
<td>1</td>
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<tr>
<td>PLSC 798</td>
<td>Master's Thesis</td>
<td>10</td>
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<tr>
<td>M.S. Plan B - Comprehensive Study Option</td>
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<tr>
<td>600-700 level courses including 3 credits of PLSC 724 or equivalent</td>
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<td>21 of the 30 credits must be in didactic courses approved for graduate credit numbered 600-689 and 700-789</td>
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<td>PLSC 790</td>
<td>Graduate Seminar</td>
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<tr>
<td>PLSC 797</td>
<td>Master's Paper</td>
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</table>

**Doctoral Program**

The Ph.D. program requires completion of at least 90 credits; this may include 30 credits from a previously earned M.S. degree (Thesis Option). A Plant Breeding and Genetics subplan is available for doctoral students wishing to complete specific coursework.

All Ph.D. students are required to participate in two instances of PLSC 892 Graduate Teaching Experience (one credit each), two instances of PLSC 790 Graduate Seminar (one credit each), and 20 research credits (PLSC 899 Doctoral Dissertation). A preliminary written and oral examination of academics related to the discipline must be passed to progress to Ph.D. candidacy. Further, a final oral examination of academics related to the discipline and the research-based dissertation, as well as a public Exit Seminar discussing their dissertation work, are required. Ph.D. candidates with a previously earned Master's degree generally require three additional years to satisfy Ph.D. requirements.

<table>
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<th>Code</th>
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<tr>
<td>M.S. (thesis option) to Ph.D.</td>
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<tr>
<td>Didactic graduate courses numbered 601-689, 700-789, or 800-889</td>
<td>36</td>
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<tr>
<td>15 of the 30 must be 700-789 or 800-889 including:</td>
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</tr>
<tr>
<td>PLSC 724</td>
<td>Field Design I (if not part of M.S. Must earn B or better)</td>
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<tr>
<td>Students focusing on Plant Breeding and Genetics must take and earn a B or better in</td>
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<tr>
<td>PLSC 611</td>
<td>Genomics</td>
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<tr>
<td>PLSC 631</td>
<td>Intermediate Genetics</td>
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<td>PLSC 718</td>
<td>Genetics &amp; Plant Improvement</td>
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<td>PLSC 790</td>
<td>Graduate Seminar</td>
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<td>PLSC 892</td>
<td>Graduate Teaching Experience</td>
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<td>PLSC 899</td>
<td>Doctoral Dissertation</td>
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<th>Credits</th>
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<tr>
<td>M.S. (thesis option) to Ph.D. - Plant Breeding and Genetics Option</td>
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<tr>
<td>600 - 800 level graduate courses including:</td>
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<tr>
<td>PLSC 611</td>
<td>Genomics</td>
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<tr>
<td>PLSC 631</td>
<td>Intermediate Genetics</td>
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</tbody>
</table>
PLSC 718  Genetics & Plant Improvement
PLSC 724  Field Design I (if not part of master's degree)
PLSC 731  Plant Molecular Genetics
PLSC 751  Advanced Plant Genetics
PLSC 776  Advanced Plant Breeding
PLSC 782  Population and Quantitative Genetics
PLSC 790  Graduate Seminar  2
PLSC 892  Graduate Teaching Experience  2
PLSC 899  Doctoral Dissertation  20

Faculty

Nonoy Bandillo, Ph.D.
University of Nebraska-Lincoln, 2016
Research Interests: Pulse Breeding, Genetics

Marisol Berti, Ph.D.
North Dakota State University, 2007
Research Interests: Forage and Biomass Crop Production

Bingcan Chen, Ph.D.
University of Massachusetts, 2012
Research Interests: Cereal and Food Chemistry

Michael J. Christoffers, Ph.D.
University of Missouri-Columbia, 1998
Research Interests: Weed Science/Genetics

David Wenhao Dai, Ph.D.
North Dakota State University, 2001
Research Interests: Woody Plant Physiology, Biotechnology

Edward L. Deckard, Ph.D.
University of Illinois, 1970
Research Interests: Crop Physiology

Elias M. Elias, Ph.D.
North Dakota State University, 1987
Research Interests: Durum Wheat Breeding, Genetics

Greta Gramig, Ph.D.
University of Wisconsin-Madison
Research Interests: Weed Biology and Ecology

Andrew J. Green, Ph.D.
Kansas State University, 2016
Research Interests: Hard Red Spring Wheat, Genetics

Harlene Hatterman-Valenti, Ph.D.
Iowa State University, 1993
Research Interests: High-Value Crop Production

Richard D. Horsley, Ph.D.
North Dakota State University, 1988
Research Interests: Barley Breeding, Genetics

Kirk A. Howatt, Ph.D.
Colorado State University, 1999
Research Interests: Weed Science, Annual Weeds

Joseph Ikley, Ph.D.
Purdue University, 2018
Research Interests: Weed Control

Burton L. Johnson, Ph.D.
North Dakota State University, 1993
Research Interests: Crop Production

Thomas J. Kalb, Ph.D.
Virginia Polytechnic Institute & State University, 1988
Research Interests: Extension Horticulture

Herman J. Kandel, Ph.D.
North Dakota State University, 1995
Research Interests: Crop Production

Chiwon W. Lee, Ph.D.
Purdue University, 1977
Research Interests: Vegetables, Floriculture, Biotechnology

Deying M. Li, Ph.D.
Iowa State University, 2001
Research Interests: Sports Turf Management

Xuehui Li, Ph.D.
University of Georgia, 2009
Research Interests: Statistical Genomics

Frank A. Manthey, Ph.D.
North Dakota State University, 1985
Research Interests: Durum Wheat Quality, Pasta/Noodle Processing

G. Francois Marais, Ph.D.
North Dakota State University, 1979
University of Stellenbosch, 1992
Research Interests: Hard Red Winter Wheat Breeding, Genetics

Phillip E. McClean, Ph.D.
Colorado State University, 1982
Research Interests: Dry Bean Genetics, Biotechnology

Esther E. McGinnis
University of Minnesota, 2013
Research Interests: Extension Horticulture, Native Plants, Perennial Hardiness, Floriculture

Michael S. McMullen, Ph.D.
University of Minnesota, 1976
Research Interests: Oat Breeding, Genetics

Carrie Miranda, Ph.D.
University of Missouri, 2018
Research Interests: Soybean Breeding, Molecular Genetics

Rebekah Oliver, Ph.D.
North Dakota State University, 2006
Research Interests: Genetics

Juan Osorno, Ph.D.
North Dakota State University, 2006
Research Interests: Dry Edible Bean Breeding

Thomas Peters, Ph.D.
North Dakota State University, 1990
Research Interests: Sugarbeet Agronomy, Weed Science

Mukhlesur Rahman, Ph.D.
University of Manitoba, 2007
Research Interests: Canola Breeding

Jiajia Rao, Ph.D.
University of Massachusetts, 2013
Research Interests: Food Chemistry, Ingredient Technology

Andy Robinson, Ph.D.
Purdue University, 2012
Research Interests: Potato Production

Kalidas Shetty, Ph.D.
University of Idaho, 1989
Research Interests: Food Safety

Asunta L. Thompson, Ph.D.
University of Idaho, 1998
Research Interests: Potato Breeding

Anuradha Vegi, Ph.D.
North Dakota State University, 2008
Research Interests: Teaching Techniques

Todd West, Ph.D.
Southern Illinois University, 2004
Research Interests: Woody Plant Improvement

Qi Zhang, Ph.D.
Kansas State University, 2007
Research Interests: Turfgrass Stress Physiology

Alan J. Zuk, Ph.D.
Kansas State University, 2005
Research Interests: Sports and Urban Turfgrass Management

Adjunct and Affiliate

James V. Anderson, Ph.D.
Virginia Polytech Institute, 1990
Research Interests: Plant Biochemistry

James Beaver, Ph.D.
University of Illinois, 1980
Research Interests: Dry Bean Genetics

David Bonnett, Ph.D.
University of Sydney, 1997
Research Interests: Wheat Breeding

Patrick M. Carr, Ph.D.
Montana State University, 1989
Research Interests: Sustainable Agriculture

Wun Shaw Chao, Ph.D.
University of California-Davis, 1996
Research Interests: Perennial Weeds

Munevver Dogramaci, Ph.D.
Cukurova University/North Dakota State University, 2000
Research Interests: Sugarbeet and Potato Research

Linda Dykes, Ph.D.
Texas A&M University, 2008
Research Interests: Food Science and Technology

Justin D. Faris, Ph.D.
Kansas State University, 1999
Research Interests: Wheat Molecular Genetics

**Jason Fiedler, Ph.D.**  
Scripps Research Institute, 2012  
Research Interests: Cereal Crop Genetics

**Shana M. Forster, Ph.D.**  
North Dakota State University, 2017  
Research Interests: Crop Production

**Jose G. Franco, Jr., Ph.D.**  
Texas A&M University, 2015  
Research Interests: Agroecology, Sustainable Food Systems

**Karen L. Fugate, Ph.D.**  
Ohio State University, 1995  
Research Interests: Sugarbeet Physiology

**Russell Gesch, Ph.D.**  
Texas A&M University, 1995  
Research Interests: Physiology of Oilseed Crops

**Salvador Alejandro Gezan, Ph.D.**  
University of Florida, 2005  
Research Interests: Statistic and Quantitative Genetics

**Michael Grusak, Ph.D.**  
University of California-Davis, 1985  
Research Interests: Crop Nutrient Quality

**Yong Q. Gu, Ph.D.**  
University of California, Riverside, 1994  
Research Interests: Wheat Genetics

**Darrin Haagenson, Ph.D.**  
Purdue University, 2001  
Research Interests: Crop Physiology and Ecology

**David P. Horvath, Ph.D.**  
Michigan State University, 1993  
Research Interests: Perennial Weed Physiology

**Brent Hulke, Ph.D.**  
University of Minnesota, 2007  
Research Interests: Flax and Sunflower Genetics

**Brian Jenks, Ph.D.**  
University of Nebraska, Lincoln, 1996  
Research Interests: Integrated Weed Management

**Blaine Johnson, Ph.D.**  
University of Nebraska, 1986  
Research Interests: Quantitative Genetics

**Edward C. Lulai, Ph.D.**  
North Dakota State University, 1978  
Research Interests: Potato Physiology

**Kevin McPhee, Ph.D.**  
University of Idaho, 1995  
Research Interests: Pulse Crops

**Grant Mehring, Ph.D.**  
North Dakota State University, 2016  
Research Interests: Agronomy; Wheat and Corn Research
Mohamed Mergoum, Ph.D.
Colorado State University, 1991
Research Interests: Hard Red Spring Wheat Breeding

Jae-Bom Ohm, Ph.D.
Kansas State University, 1996
Research Interests: Grain Science

Michael Ostlie, Ph.D.
Colorado State University, 2012
Research Interests: Weed Science

Timothy Porch, Ph.D.
Cornell University, 2012
Research Interests: Dry Bean Breeding and Genetics

Gautam Pradhan, Ph.D.
Kansas State University, 2011
Research Interests: Crop Physiology

Lili Qi, Ph.D.
Nanjing Agricultural University, 1997
Research Interests: Wheat Genetics

Calvin Trostle, Ph.D.
Texas A&M, 1996
Research Interests: Row Crops, Peanut, Alfalfa

Gerald J. Seiler, Ph.D.
North Dakota State University, 1980
Research Interests: Sunflower and Sugarbeet Germplasm

Thomas Walk, Ph.D.
Pennsylvania State University, 2005
Research Interests: Plant Physiology, Statistics

Jochum Wiersma, Ph.D.
University of Minnesota, 1995
Research Interests: Small Grains

Steven S. Xu, Ph.D.
North Dakota State University, 1994
Research Interests: Hard Red Spring Wheat Development

Shengming Yang, Ph.D.
North Dakota State University, 1994
Research Interests: Hard Red Spring Wheat Development