PLANT BIOLOGY (CAS)

Description

Website: http://agronomy.unl.edu/plant-biology

The plant biology major is designed to provide a flexible entry for undergraduate students that have an interest in the plant sciences. Once enrolled in the program, students will take a core of classes that will allow them to continue in the plant biology major or would also allow them to easily transfer to other Life Sciences programs. Students will have the opportunity to interact with the faculty of the Center for Plant Science Innovation as well as other departments and schools for advising and research opportunities.

The goal of the plant biology program is to offer a field of study to students who are interested and talented in the basic sciences and mathematics and who:

1. May never have considered applying this knowledge to plants.
2. Have always dreamed of this field of study.
3. Have always had an interest in plants but are uncertain that this field of study is right for them.

Studying plant biology will allow students to explore and understand plants at molecular, cellular, physiological, organismal, population, and community levels and by taking ecological, evolutionary, agricultural, and horticultural perspectives. This is accomplished through required courses in different scientific fields (e.g., biology, biochemistry, chemistry, agronomy, horticulture) and through different options in the major (ecology and management option and biotechnology option).

The plant biology program includes a career experience/internship course (AGRO 295/RNGE 295/SOIL 295, BIOS 395, HORT 395, NRES 497) which provides the opportunity to gain work experience in an off-campus setting related to a student’s academic and career objectives.

A research project initiated by the beginning of the junior year is required.

College Admission

The entrance requirements for the College of Arts and Sciences (CAS), including any of the majors or minors offered through the college, are the same as the UNL General Admission Requirements. In addition to these requirements, the College of Arts and Sciences strongly recommends a third and fourth year of one foreign language in high school. Four years of high school coursework in the same language will fulfill the College of Arts and Sciences’ language requirement. It will also allow students to continue language study at a more advanced level at UNL and provide more opportunity to study abroad.

ACADEMIC AND CAREER Advising

Academic and Career Advising Center

The Academic and Career Advising Center in 107 Oldfather Hall is the undergraduate hub for CAS students in all majors. Centrally located and easily accessed, students encounter friendly, knowledgeable people who are eager to help. Students visit the Advising Center in 107 Oldfather Hall to:

• Choose or change their major, minor, or degree program.
• Check in on policies, procedures, and deadlines.

• Get a college approval signature from the Dean’s representative, Sr. Director of Advising and Student Success.

While the assigned academic advisor should be the student’s primary contact, there are daily walk-ins from 12-3 where a general academic advisor can answer a quick question. In addition, the CAS Career Coaches are located here. They help students explore majors and minors, gain experience, and develop a plan for life after graduation. Not sure where to go or who to ask? The Advising Center team can help.

Assigned Academic Advisors

Academic advisors are critical resources dedicated to students’ academic, personal, and professional success. Every CAS student is assigned an academic advisor based on their primary major. Since most CAS students have more than just a single major, it is important to get to know the advisor for any minors or additional majors. Academic advisors work closely with the faculty to provide the best overall support and the discipline-specific expertise.

Assigned advisors are listed in MyRED (https://its.unl.edu/myunl) and their offices may be located in or near the department of the major for which they advise or in the Academic and Career Advising Center. Students who have declared a pre-health or pre-law area of interest will also work with advisors in the Exploratory and Pre-Professional Advising Center (Explore Center) in 127 Love South, who are specially trained to guide students preparing to enter a professional school.

For complete and current information on advisors for majors, minors, or pre-professional areas, contact the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, http://cas.unl.edu/advising.

Career Coaching

The College believes that Academics + Experience = Opportunities and encourages students to complement their academic preparation with real-world experience, including internships, research, education abroad, service, and leadership. Arts and sciences students have access to a powerful network of faculty, staff, and advisors dedicated to providing information and support for their goals of meaningful employment or advanced education. Arts and sciences graduates have unlimited career possibilities and carry with them important career competencies—communication, critical thinking, creativity, context, and collaboration. They have the skills and adaptability that employers universally value. Graduates are not only prepared to effectively contribute professionally in the real world, but they have a solid foundation to excel in an increasingly global, technological, and interdisciplinary world.

Students should contact the career coaches in the Arts and Sciences Academic and Career Advising Center in 107 Oldfather, or their assigned advisor, for more information. The CAS career coaches help students explore career options, identify ways to build experience, and prepare to apply for internships, jobs, or graduate school, including help with resumes, applications, and interviewing.

ACE Requirements

Students must complete one course for each of the ACE Student Learning Outcomes below. Certified course choices are published in the degree audit, or visit the ACE website (http://ace.unl.edu) for the most current list of certified courses.
ACE Student Learning Outcomes

ACE 1: Write texts, in various forms, with an identified purpose, that respond to specific audience needs, integrate research or existing knowledge, and use applicable documentation and appropriate conventions of format and structure.

ACE 2: Demonstrate competence in communication skills.

ACE 3: Use mathematical, computational, statistical, logical, or other formal reasoning to solve problems, draw inferences, justify conclusions, and determine reasonableness.

ACE 4: Use scientific methods and knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.

ACE 5: Use knowledge, historical perspectives, analysis, interpretation, critical evaluation, and the standards of evidence appropriate to the humanities to address problems and issues.

ACE 6: Use knowledge, theories, and research perspectives such as statistical methods or observational accounts appropriate to the social sciences to understand and evaluate social systems or human behaviors.

ACE 7: Use knowledge, theories, or methods appropriate to the arts to understand their context and significance.

ACE 8: Use knowledge, theories, and analysis to explain ethical principles and their importance in society.

ACE 9: Exhibit global awareness or knowledge of human diversity through analysis of an issue.

ACE 10: Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection.

College Degree Requirements

College Distribution Requirements – BA and BS

The College of Arts and Sciences distribution requirements are common to both the bachelor of arts and bachelor of science degrees and are designed to ensure a range of courses. By engaging in study in several different areas within the College, students develop the ability to learn in a variety of ways and apply their knowledge from a variety of perspectives. All requirements are in addition to University ACE requirements, and no course can be used to fulfill both an ACE outcome and a College Distribution Requirement.

- A student may not use a single course to satisfy more than one College Distribution Requirement, with the exception of CDR Diversity. Courses used to meet CDR Diversity may also meet CDR Writing, CDR Humanities, or CDR Social Science.
- Independent study or reading courses and internships cannot be used to satisfy distribution requirements.
- Courses from interdisciplinary programs will be applied in the same area as courses from the home/cross-listed department.

College Distribution Requirements

<table>
<thead>
<tr>
<th>CDR: Written Communication</th>
<th>3</th>
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</table>
Select from courses approved for ACE outcome 1.

| CDR: Natural, Physical, and Mathematical Sciences with Lab | 4 |

Some courses from geography and anthropology may also be used to satisfy the lab requirement above.

1. Select from biochemistry, biological sciences, chemistry, computer science, geology, meteorology, mathematics, physics, and statistics. Must include one lab in the natural or physical sciences. Lab courses may be selected from biochemistry, biological sciences, chemistry, geology, meteorology, and physics.

2. Select from classics, English, history, modern languages and literatures, philosophy, and religious studies.

3. Select from anthropology, communication studies, geography, political science, psychology, or sociology.

Language Requirement

Fulfilled by the completion of the 6-credit-hour second-year sequence in a single foreign language in one of the following departments: Classics and religious studies or modern languages and literatures. Instruction is currently available in Arabic, Chinese, Czech, French, German, Greek, Japanese, Latin, Russian, and Spanish.

A student who has completed the fourth-year level of one foreign language in high school is exempt from the languages requirement, but encouraged to continue on in their language study.

Credit Hours Subtotal: 13-32

1. See Degree Audit or a College of Arts and Sciences advisor for approved geography and anthropology courses that apply as natural science.

2. Language courses numbered 220 and below do not fulfill the CDR Humanities.

3. See Degree Audit or College of Arts and Sciences advisor for list of natural/physical science courses in anthropology, geography, and psychology that do not apply as social science.

Scientific Base - BS Only

The bachelor of science degree requires students to complete 60 hours in mathematical, physical, and natural sciences. Approved courses for scientific base credit come from the following College of Arts and Sciences disciplines: actuarial science, anthropology (selected courses), astronomy, biochemistry (excluding BIOC 101), biological sciences (excluding BIOS 100 or BIOS 203), chemistry (excluding CHEM 101), computer science (excluding CSCE 10), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104), meteorology, microbiology (excluding MBIO 101), and physics.
Course Level Requirements

Grades Rules
Restrictions on C- and D Grades
The College will accept no more than 15 semester hours of C- and D grades from other domestic institutions except for UNO and UNK. All courses taken at UNO and UNK impact the UNL transcript. No transfer of C- and D grades can be applied toward requirements in a major or a minor. No UNL C- and D grades can be applied toward requirements in a major or a minor. International coursework (including education abroad) with a final grade equivalent to a C- or lower will not be validated by College of Arts and Sciences departments to be degree applicable.

Pass/No Pass Privilege
The College of Arts and Sciences adheres to the University regulations for the Pass/No Pass (P/N) privilege with the following additional regulations:

- Pass/No Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
- Most arts and sciences departments and programs do not allow courses graded Pass/No Pass to apply to the major or minor. Students should refer to the department’s or program’s section of the catalog for clarification. By college rule, departments can allow up to 6 hours of Pass/No Pass in the major or minor.
- Departments may specify that certain courses of theirs can be taken only on a P/N basis.
- The college will permit no more than a total of 24 semester hours of P/N grades to be applied toward degree requirements. This total includes all Pass grades earned at UNL and other U.S. schools. NOTE: This 24-hour limit is more restrictive than the University regulation.

Grading Appeals
A student who feels that he/she has been unfairly graded must ordinarily take the following sequential steps in a timely manner, usually by initiating the appeal in the semester following the awarding of the grade:

1. Talk with the instructor concerned. Most problems are resolved at this point.
2. Talk to the instructor’s department chairperson.
3. Take the case to the Grading Appeal Committee of the department concerned. The Committee should be contacted through the department chairperson.
4. Take the case to the College Grading Appeals Committee by contacting the Dean’s Office, 1223 Oldfather Hall.

Course Level Requirements

Core Requirements

Mathematics and Statistics

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>MATH 106</td>
<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>STAT 218</td>
<td>Introduction to Statistics</td>
<td>3</td>
</tr>
<tr>
<td>Credit</td>
<td>Subtotal:</td>
<td>8</td>
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Life Sciences

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<tr>
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<tr>
<td>LIFE 120</td>
<td>Fundamentals of Biology I</td>
<td>4</td>
</tr>
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</table>
& LIFE 120L | Fundamentals of Biology I Laboratory | 4            |
| LIFE 121 | Fundamentals of Biology II            | 4            |
& LIFE 121L | Fundamentals of Biology II Laboratory | 4            |
| Credit   | Subtotal:                             | 8            |
| Hours    | **Subtotal:**                         |              |

Physics


Learning Outcomes

Graduates of plant biology will be able to:

1. Be confident in explaining how various plants grow and reproduce and predict how they will respond to their growing environment.
2. Plan and conduct experiments that are designed to test hypotheses and then communicate their discoveries in formats designed for other scientists or for the public.
3. Use the principles of ecology to analyze and interpret the interactions of the plant, animal, environmental, and economic aspects of grassland ecosystems. (Ecology and Management Option)
4. Identify management strategies for grasslands that ensure sustained productivity and resilience. (Ecology and Management Option)
5. Envision and design genetic and production improvements in plants to better meet the needs of people or changes in plant production environments (Biotechnology Option)
6. Be competitive applicants for graduate programs worldwide in plant biology.

Major Requirements

Catalog to Use

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to and enrolled as a degree-seeking student at UNL. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at UNL in the College of Arts and Sciences. Students must complete all degree requirements from a single catalog year. Beginning in 1990-1991, the catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

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**Core Requirements**

**Mathematics and Statistics**

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</table>
& LIFE 120L | Fundamentals of Biology I Laboratory | 4            |
| LIFE 121 | Fundamentals of Biology II            | 4            |
& LIFE 121L | Fundamentals of Biology II Laboratory | 4            |
| Credit   | Subtotal:                             | 8            |
| Hours    | **Subtotal:**                         |              |

**Physics**
### Plant Biology Core

- **NRES 220** Principles of Ecology 4
- & **NRES 222** and Ecology Laboratory
- or **BIOS 207** Ecology and Evolution

### Biochemistry

- **BIOC 401** and Laboratory for Elements of Biochemistry

### Plant Biology Core

- **AGRO 153** / **HORT 153** / **SOIL 153** Soil Resources 4
- **AGRO 215** / **HORT 215** / **TLMT 215** Genetics 4
- or **BIOS 206** General Genetics

### Plant Biology Internship/Career Experience

- **BIOS 395** Internship 1
- **HORT 395** Internship in Horticulture
- **AGRO 295** / **RNGE 295** / **SOIL 295** Internship
- **NRES 497** Career Experiences in Natural Resource Sciences 1

### Plant Biology Independent Study/Current Project

- **BIOS 498** Independent Research in Biological Sciences 1-3
- **AGRO 496** / **RNGE 496** / **SOIL 496** Independent Study
- **HORT 396** Current Projects and Topics in Horticulture
- or **HORT 399** Independent Study
- **NRES 496** Independent Study

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**Specific Major Requirements**

Select either the Ecology and Management Option or the Biotechnology Option as described below.

### Ecology and Management Option

#### Required Courses

- **AGRO 245** / **NRES 245** Introduction to Grassland Ecology and Management 3-4
- or **NRES 310** Introduction to Forest Management
- **AGRO 444** / **NRES 444** / **RNGE 444** Ecosystem Monitoring and Assessment 3

#### Additional Ecology and Management Option Courses

Select at least 3 hours from each of the following five areas:

**Water/Climate**

- **METR 100** Weather and Climate 3-4
- **NRES 208** Applied Climate Sciences
- **NRES 408** / **AGRO 408** / **GEOG 408** / **HORT 408** / **METR 408** / **WATS 408** Microclimate: The Biological Environment
- **NRES 281** / **GEOG 281** / **NRES 281** Introduction to Water Science

**Geospatial Information Sciences**

Select at least 3 hours from the following:

- **GEOG 412** / **NRES 412** Introduction to Geographic Information Systems
- **GEOG 418** / **NRES 418** Introduction to Remote Sensing
- **NRES 312** / **GEOG 312** Introduction to Spatial Sciences

**Plant Identification**

- **AGRO 442** / **NRES 442** / **RNGE 442** Wildland Plants 3

**Plant-Animal-Organismal Interactions**

Select at least 3 hours from the following:

- **AGRO 340** / **RNGE 340** Range Management and Improvement 3-4
- **AGRO 460** / **BIOS 460** / **SOIL 460** / **NRES 460** Soil Microbiology
- **BIOS 317** The Biology of Plants
- **BIOS 368** Plants in Human Medicine: Biological, Social, and Ethical Dimensions
- **BIOS 475** Avian Biology
Plant Biology (CAS)

BIOS 476 / NRES 476  Mammalogy
ENTO 115 / BIOS 115 & ENTO 116 / BIOS 116  Insect Biology and Insect Identification
NRES 211  Introduction to Conservation Biology
NRES 311  Wildlife Ecology and Management
NRES 348  Wildlife Damage Management

Ecology and Management
Select at least 3 hours from the following:  3-4
AGRO 204  Resource-Efficient Crop Management
AGRO 240 / RNGE 240  Forage Crop and Pasture Management
AGRO 440 / NRES 440 / RNGE 440  Great Plains Ecosystem
BIOS 454 / NRES 454  Ecological Interactions
BIOS 457 / GEOL 457  Ecosystem Ecology
BIOS 470  Prairie Ecology
NRES 310  Introduction to Forest Management
NRES 417 / HORT 418  Agroforestry Systems in Sustainable Agriculture
NRES 424  Forest Ecology
NRES 459 / BIOS 459 / WATS 459  Limnology
NRES 468 / BIOS 458 / WATS 468  Wetlands

Credit Hours Subtotal:  15
Total Credit Hours  21-22

Biotechnology Option

Required Courses
BIOS 312  Microbiology  3
Select one of the following:  3-4
BIOS 337  Applications of Bioinformatics
BIOC 442 / STAT 442  Computational Biology
BIOS 427  Practical Bioinformatics Laboratory

Credit Hours Subtotal:  6-7

Additional Biotechnology Courses
Select at least 17 hours from the following three areas with at least 3 hours in each area:

Biological Sciences
Select at least 3 hours from the following:  3-6
AGRO 270 / HORT 270 / NRES 270 / PLPT 270  Biological Invaders

AGRO 460 / NRES 460 / SOIL 460  Soil Microbiology
BIOS 205  Genetics, Molecular and Cellular Biology Laboratory
BIOS 302  Cell Biology
BIOS 317  The Biology of Plants
BIOS 407  Biology of Cells and Organelles
BIOS 418  Advanced Genetics
BIOS 420 / MBIO 420  Molecular Genetics
BIOS 425  Plant Biotechnology
BIOS 434  Plant Biochemistry
BIOS 471  Plant Systematics
or BIOS 429  Phylogenetic Biology
BIOS 477  Bioinformatics and Molecular Evolution

Applied Plant Biology
Select at least 3 hours from the following:  3-6
AGRO 131 / HORT 131  Plant Science and Agronomic Plant Science Laboratory
& AGRO 132  or HORT 131  Plant Science
& HORT 133  and Horticultural Plant Science Laboratory
AGRO 408 / GEOG 408 / HORT 408 / METR 408 / NRES 408 / WATS 408  Microclimate: The Biological Environment
AGRO 411  Crop Genetic Engineering
AGRO 412  Crop and Weed Genetics
BIOS 368  Plants in Human Medicine: Biological, Social, and Ethical Dimensions
HORT 221  Plant Propagation
NRES 406 / AGRO 406 / HORT 406  Plant Ecophysiology: Theory and Practice
PLPT 369 / BIOS 369  Introductory Plant Pathology

Plant and Food System Management
Select at least 3 hours from the following:  3-6
AGRO 204  Resource-Efficient Crop Management
AGRO 240 / RNGE 240  Forage Crop and Pasture Management
or AGRO 227  Introductory Turfgrass Management
HORT 227 / TLMT 227
AGRO 405  Crop Management Strategies
or AGRO 435  Agroecology
HORT 435 / NRES 435
AGRO 426 / HORT 426 / NRES 426  Invasive Plants
AGRO 437  Animal, Food and Industrial Uses of Grain
AGRO 438 Producing Grain for Animal, Food and Industrial Uses

ENTO 115 / BIOS 115 & ENTO 116 / BIOS 116 Insect Biology and Insect Identification

FDST 205 Food Composition and Analysis

HORT 306 Greenhouse Practices and Management

HORT 352 Production and Physiology of Horticultural Crops

HORT 355 Perennial, Pot and Bedding Plant Production Laboratory

HORT 362 Nursery Crop Production

Credit Hours Subtotal: 17

Total Credit Hours 23-24

1 Students considering graduate school should also take BIOS 478.

Additional Major Requirements

Grade Rules

C- and D Grades
A grade of C or better is required in all courses in the major or minor.

Pass/No Pass
No course taken Pass/No Pass will count toward the major or minor, except for the Career Experience courses.

Requirements for the minor Offered by Department

Requirements for the minor include 19 hours of coursework, with a minimum of 7 hours at the 300 level or above.

Requirements

Select one of the following: 4

AGRO 131 / HORT 131 & AGRO 132 Plant Science and Agronomic Plant Science Laboratory

HORT 131 / AGRO 131 & HORT 133 Plant Science and Horticultural Plant Science Laboratory

AGRO 278 Botany 4

AGRO 325 Introductory Plant Physiology 4

Credit Hours Subtotal: 12

Focus

Select either the Biotechnology Focus or Ecology and Management Focus 7-8

Biotechnology Focus

AGRO 215 / HORT 215 / TLMT 215 Genetics

or BIOS 206 General Genetics

Any 300- or 400-level course listed under the Plant Biology Major—Biotechnology Option

Ecology and Management Focus

NRES 220 Principles of Ecology

NRES 222 Ecology Laboratory

Any 300- or 400-level course listed under the Plant Biology Major—Ecology and Management Option

Credit Hours Subtotal: 7-8

Total Credit Hours 19-20

Grade Rules

C- and D Grades
A grade of C or better is required in all courses in the major or minor.

Pass/No Pass
No course taken Pass/No Pass will count toward the major or minor, except for the Career Experience courses.

PLEASE NOTE
This document represents a sample 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences to enrich your undergraduate education such as internships, education abroad, undergraduate research, learning communities, and service learning and community-based learning.

Plant Biology - Ecology and Management (B.S.)

Career Information

The following represents a sample of the internships, jobs and graduate school programs that current students and recent graduates have reported.

Transferable Skills

• Communicate results of scientific experiments to scientific and non-scientific audiences
• Apply mathematical and scientific skills to solve real-world problems
• Make predictions using mathematical, statistical, and scientific modeling methods
• Define problems and identifying causes
• Understand and use proper laboratory and technical skills and instruments
• Collaborate with a team to develop solutions
• Confidently navigate complex, ambiguous projects and environments
• Design and implement research experiments
• Document and replicate processes and procedures

Jobs of Recent Graduates

• North American Trait Integration Breeder, Monsanto - Chesterfield MO
• Plant Protection Technician, USDA - Lincoln NE
• Data Analyst, Zoex Corporation - Houston TX
• Associate Sales Manager, Theisen Seed LLC - Atkinson NE
• Distance Education Instructor, University of Nebraska - Lincoln NE
• Site Manager, Sustainable Agriculture Education - Berkeley CA
• Groundskeeper, Burr Oak Lodge - Eagle NE
• Graduate Research assistant, University of Nebraska - Lincoln NE
• Student of Doctor of Health Program, UNL - Lincoln NE
Internships

- Intern, DuPont Pioneer - Johnston IA
- Research Assistant, UNL Plant Pathology - Lincoln NE
- Cover Crop Research Intern, UNL Agronomy and Horticulture - Lincoln NE
- Research Intern, Nebraska Forest Service - Lincoln NE
- Intern, Grassland Ecology - Wood River NE
- Pioneer Sales Associate Intern, Theisen Seed LLC - Atkinson NE
- Crop Production Intern, UNL Agronomy and Horticulture - Lincoln NE
- Research Intern, UNL Molecular Plant Physiology - Lincoln NE

Graduate & Professional Schools

- Ph.D., Genetics, Iowa State University - Ames IA
- Ph.D., Evolutionary Ecology, Colorado State University - Fort Collins CO
- Ph.D., Plant Breeding and Genetics, Purdue University - Lafayette IN
- Ph.D., Entomology, University of Arkansas - Fayetteville AR
- Ph.D., Agronomy and Horticulture, University of Nebraska-Lincoln - Lincoln NE
- Master’s Degree, Agronomy, University of Nebraska-Lincoln - Lincoln NE
- Master’s Degree, Plant Breeding and Genetics, University of Nebraska-Lincoln - Lincoln NE
- Master’s Degree, Biological Sciences, University of Nebraska-Lincoln - Lincoln NE
- Master’s Degree, Entomology and Plant Pathology, Colorado State University - Fort Collins CO
- Master’s Degree, Horticulture, University of Nebraska-Lincoln - Lincoln NE
- Ph.D., Horticulture, University of Nebraska Lincoln - Lincoln NE