UNIVERSITY OF MINNESOTA
Driven to Discover℠

Twin Cities Campus

Plant Science B.S.

Agronomy & Plant Genetics, Entomology, Horticultural Science, Plant Pathology

College of Food, Agricultural and Natural Resource Sciences

- Program Type: Baccalaureate
- Requirements for this program are current for Fall 2020
- Required credits to graduate with this degree: 120
- Required credits within the major: 75 to 79
- Degree: Bachelor of Science

The plant science major provides a broad course of study in plant sciences, as well as options to concentrate more specifically within an area of individual interest. The major prepares students for rewarding careers in diverse areas, such as research and development (plant breeding, genetics, or plant molecular biology); food and plant production (sustainable and organic production or floriculture and nursery production); plant use and function (restoration of damaged landscapes); and management of landscapes (agro-ecology and turf grass management). Students gain experience in the use of plants to produce food and other useful products, alter environments, restore damaged landscapes, improve human health and well-being, educate people about science and agriculture, improve community environments, and provide recreational and practical benefits to the public.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Admission Requirements

For information about University of Minnesota admission requirements, visit the Office of Admissions website.

General Requirements

All students are required to complete general University and college requirements including writing and liberal education courses. For more information about University-wide requirements, see the liberal education requirements.Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

Program Requirements

At least 13 upper-division credits in the major must be taken at the University of Minnesota Twin Cities campus.

Core Courses

AGRO 1661W - Engaging Plant Science [WI] (2.0 cr)
BIOL 1009 - General Biology [BIOL] (4.0 cr)
CFAN 2333 - Insects, Microbes, and Plants: Ecology of Pest Management [TS] (3.0 cr)
HORT 1015 - Plant Families for Plant People (4.0 cr)
SOIL 2125 - Basic Soil Science [PHYS, ENV] (4.0 cr)

Mathematics

MATH 1031 - College Algebra and Probability [MATH] (3.0 cr)
or MATH 1051 - Precalculus I [MATH] (3.0 cr)
or MATH 1142 - Short Calculus [MATH] (4.0 cr)
or MATH 1241 - Calculus and Dynamical Systems in Biology [MATH] (4.0 cr)
or MATH 1271 - Calculus I [MATH] (4.0 cr)

Statistics & Computing

STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
or BIOL 3272 - Applied Biostatistics (4.0 cr)
or ESPM 3012 - Statistical Methods for Environmental Scientists and Managers [MATH] (4.0 cr)
or CSCI 1133 - Introduction to Computing and Programming Concepts (4.0 cr)

Plant Breeding & Genetics

PLSC 3401 - Plant Genetics and Breeding (4.0 cr)

Plant Physiology

PLSC 3005W - Introduction to Plant Physiology [WI] (4.0 cr)

Biology, Botany, or Plant Propagation

HORT 1001 - Plant Propagation [BIOL] (4.0 cr)
or PMB 2022 - General Botany (3.0 cr)

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Chemistry
CHEM 1065 - Chemical Principles I Laboratory [PHYS] (1.0 cr)
Chem Lecture Options
CHEM 1061 - Chemical Principles I [PHYS] (3.0 cr)
or CHEM 1081 - Chemistry for the Life Sciences I [PHYS] (3.0 cr)
Biochemistry
Students enrolled in Integrated plant science BS/MS applied plant science plant breeding must enroll in BIOC 3021 rather than HORT 2100
HORT 2121 - Agricultural Biochemistry (3.0 cr)
or BIOC 3021 - Biochemistry (3.0 cr)
Experiential Learning
HORT 4096W *{Inactive}*[WI] (1.0 cr)
or AGRO 4096W - Professional Experience Program: Internships [WI] (2.0 cr)
or AGRO 4094W - Undergraduate Directed Thesis Research [WI] (2.0 cr)
Interdisciplinary Learning
Select one course from the list:
AGRO 3203W - Environment, Global Food Production, and the Citizen [GP, WI] (3.0 cr)
or AGRO 3305 - Agroecosystems of the world [GP] (3.0 cr)
or ANSC 3203W - Environment, Global Food Production, and the Citizen [GP, WI] (3.0 cr)
or APEC 3202 - An Introduction to the Food System: Analysis, Management and Design (3.0 cr)
or ESPM 1011 - Issues in the Environment [ENV] (3.0 cr)
or ESPM 3575 - Wetlands (3.0 cr)
or FSCN 1102 - Food: Safety, Risks, and Technology [CIV] (3.0 cr)
or FW 2001W - Introduction to Fisheries, Wildlife, and Conservation Biology [ENV, WI] (3.0 cr)
or PLPA 2003 - Plague, Famine, and Beer: The Impact of Microscopic Organisms on Human Civilization [HIS] (3.0 cr)
or GCC 3017 - World Food Problems: Agronomics, Economics and Hunger [GP] (3.0 cr)
or HORT 5071 - Ecological Restoration (4.0 cr)
or ESPM 5071 - Ecological Restoration (4.0 cr)
Plant Identification
HORT 4110 - Spring Flowering Bulbs (1.0 cr)
or HORT 4111 *{Inactive}*(1.0 cr)
or HORT 4112 - Flowering Trees and Shrubs (1.0 cr)
or HORT 4113 *{Inactive}*(1.0 cr)
or AGRO 2501 - Plant Identification for Urban and Rural Landscapes (1.0 cr)
Production Systems
HORT 4141W - Scheduling Crops for Protected Environments [WI] (4.0 cr)
or FDSY 2101 - Plant Production Systems (3.0 cr)

Upper Division Writing Intensive within the major
Students are required to take one upper division writing intensive (WI) course within the major. If that requirement has not been satisfied within the core major requirements, students must choose one course from the following list. Some of these courses may also fulfill other major requirements.
Take 0 - 1 course(s) from the following:
•PLSC 3005W - Introduction to Plant Physiology [WI] (4.0 cr)
•HORT 4096W *{Inactive}*[WI] (1.0 cr)
•AGRO 4096W - Professional Experience Program: Internships [WI] (2.0 cr)

Program Sub-plans
Students are required to complete one of the following sub-plans.

Plant Breeding
In consultation with their faculty mentor, students develop a plant breeding track consisting of at least 24 credits, with a minimum of 15 credits at the 3xxx-level or above. Of these 24 credits, students need to take a minimum of 12 credits of Agro, Ent, Hort, PLSC, or PlPa designators.

Students interested in this sub-plan for early graduate school admission in plant breeding and genetics should visit plantscience.umn.edu or contact your advisor.

Plant Breeding
Take 24 or more credit(s) from the following:
•CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
•CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
•CHEM 2301 - Organic Chemistry I (3.0 cr)
•PLPA 2001 - Introductory Plant Pathology (3.0 cr)

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•AGRO 3660 - Plant Genetic Resources: Identification, Conservation, and Utilization (3.0 cr)
•GCD 4034 - Molecular Genetics and Genomics (3.0 cr)
•HORT 4071W - Applications of Biotechnology to Plant Improvement [WI] (3.0 cr)
•AGRO 5021 - Plant Breeding Principles (3.0 cr)
•AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3.0 cr)
•HORT 4141W - Scheduling Crops for Protected Environments [WI] (4.0 cr)
•HORT 4461 - Horticultural Marketing (3.0 cr)
•AGRO 2022 - Growth and Development of Minnesota Field Crops (1.0 cr)
•PLSC 3002 - Seed Science, Technology, and Society (2.0 cr)
•BIOL 4003 - Genetics (3.0 cr)
•AGRO 1103 - Crops, Environment, and Society [ENV] (4.0 cr)
•AGRO 5431 - Applied Plant Genomics and Bioinformatics (3.0 cr)
•PLPA 5301 - Large Scale Omic Data in Plant Biology (3.0 cr)
•HORT 5058 *{Inactive}*(3.0 cr)
•CSCI 1913 - Introduction to Algorithms, Data Structures, and Program Development (4.0 cr)
•AGRO 2402 - The Science of Cannabis (2.0 cr)
•**Directed Study & Directed Research**

Directed Study

HORT 3093 - Directed Study (1.0 - 4.0 cr)
or AGRO 3093 - Directed Study (1.0 - 4.0 cr)
or PLSC 3093 - Directed Study (1.0 - 4.0 cr)
or FDSY 3093 - Directed Study (1.0 - 4.0 cr)
or PLPA 3993 - Directed Study (1.0 - 4.0 cr)

or **Directed Research**

HORT 3094 - Directed Research (1.0 - 4.0 cr)
or AGRO 3094 *{Inactive}*(1.0 - 4.0 cr)
or PLSC 3094 - Directed Research (1.0 - 4.0 cr)
or FDSY 3094 - Directed Research (1.0 - 4.0 cr)
or ENT 3294 - Directed Research in Entomology (1.0 - 4.0 cr)

Agroecology

In consultation with their faculty mentor, students develop an agroecology track consisting of at least 24 credits, with a minimum of 15 credits at the 3xxx-level or above. Of these 24 credits, students need to take a minimum of 12 credits of Agro, Ent, Hort, PLSC, or PlPa designators.

Agroecology

Take 24 or more credit(s) from the following:

•CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
•CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
•CHEM 2301 - Organic Chemistry I (3.0 cr)
•AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3.0 cr)
•AGRO 3203W - Environment, Global Food Production, and the Citizen [GP, WI] (3.0 cr)
•ENT 3925 *{Inactive}*(3.0 cr)
•HORT 5071 - Ecological Restoration (4.0 cr)
•PLPA 2001 - Introductory Plant Pathology (3.0 cr)
•ESPM 3108 - Ecology of Managed Systems [ENV] (3.0 cr)
•FNRM 3501 - Arboriculture: Selection and Maintenance of Trees (3.0 cr)
•AGRO 2022 - Growth and Development of Minnesota Field Crops (1.0 cr)
•HORT 1014 - The Edible Landscape [TS] (3.0 cr)
•ENT 4251 - Forest and Shade Tree Entomology (3.0 cr)
•PLPA 3003 - Diseases of Forest and Shade Trees (3.0 cr)
•AGRO 1103 - Crops, Environment, and Society [ENV] (4.0 cr)
•AGRO 3305 - Agroecosystems of the world [GP] (3.0 cr)
•AGRO 3660 - Plant Genetic Resources: Identification, Conservation, and Utilization (3.0 cr)
•AGRO 4605 - Strategies for Agricultural Production and Management (3.0 cr)
•PLSC 3002 - Seed Science, Technology, and Society (2.0 cr)
•HORT 1061 - The Sustainable Lawn (3.0 cr)
•AGRO 2502 - Introduction to Integrated Weed Management (1.0 cr)
•AGRO 4888 - Issues in Sustainable Agriculture (2.0 cr)
•EEB 3001 - Ecology and Society [ENV] (3.0 cr)
•SOIL 4111 - Introduction to Precision Agriculture (3.0 cr)
•LA 1001 *{Inactive}*[ENV] (3.0 cr)
•LA 1201 - Learning from the Landscape [AH, DSJ] (3.0 cr)
•LA 1301 - Introduction to Landscape Architecture Drawing [AH] (3.0 cr)
•LA 1401 - The Designed Environment [AH] (3.0 cr)
•LA 3003 - Climate Change Adaptation (3.0 cr)

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•LA 3501 - Environmental Design and Its Biological and Physical Context [ENV] (3.0 cr)
•LAAS 5416 - Precision Agriculture and Nutrient Management (3.0 cr)
•AGRO 5321 - Ecology of Agricultural Systems (3.0 cr)
•AGRO 2402 - The Science of Cannabis (2.0 cr)
•SOIL 3416 - Plant Nutrients in the Environment (3.0 cr)
or ESPM 3612W - Soil and Environmental Biology [WI] (4.0 cr)
•**Directed Study & Directed Research**
Directed Study
HORT 3093 - Directed Study (1.0 - 4.0 cr)
or AGRO 3093 - Directed Study (1.0 - 4.0 cr)
or PLSC 3093 - Directed Study (1.0 - 4.0 cr)
or FDSY 3093 - Directed Study (1.0 - 4.0 cr)
or PLPA 3993 - Directed Study (1.0 - 4.0 cr)
or **Directed Research**
HORT 3094 - Directed Research (1.0 - 4.0 cr)
or AGRO 3094 *{Inactive}*(1.0 - 4.0 cr)
or PLSC 3094 - Directed Research (1.0 - 4.0 cr)
or FDSY 3094 - Directed Research (1.0 - 4.0 cr)
or ENT 3294 - Directed Research in Entomology (1.0 - 4.0 cr)

Horticultural Production

In consultation with their faculty mentor, students develop a horticultural production track consisting of at least 24 credits, with a minimum of 15 credits at the 3xxx-level or above. Of these 24 credits, students need to take a minimum of 12 credits of Agro, Ent, Hort, PLSC, or PlPa designators.

Horticultural Production
Take 24 or more credit(s) from the following:
•HORT 3131 - Student Organic Farm Planning, Growing, and Marketing (3.0 cr)
•AGRO 3203W - Environment, Global Food Production, and the Citizen [GP, WI] (3.0 cr)
•AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3.0 cr)
•AGRO 4888 - Issues in Sustainable Agriculture (2.0 cr)
•ENT 1005 - Insect Biology with Lab [BIOL] (4.0 cr)
•PLPA 2001 - Introductory Plant Pathology (3.0 cr)
•AGRO 4605 - Strategies for Agricultural Production and Management (3.0 cr)
•HORT 4141W - Scheduling Crops for Protected Environments [WI] (4.0 cr)
•HORT 5031 *{Inactive}*(3.0 cr)
•HORT 5032 *{Inactive}*(3.0 cr)
•HORT 4461 - Horticultural Marketing (3.0 cr)
•PLSC 3002 - Seed Science, Technology, and Society (2.0 cr)
•HORT 1003 - Organic Gardening: From Balconies to Backyards (3.0 cr)
•HORT 1014 - The Edible Landscape [TS] (3.0 cr)
•HORT 1031 - Vines and Wines: Introduction to Viticulture and Enology (3.0 cr)
•PLPA 3003 - Diseases of Forest and Shade Trees (3.0 cr)
•HORT 5012 *{Inactive}*(3.0 cr)
•SOIL 4111 - Introduction to Precision Agriculture (3.0 cr)
•LAAS 5416 - Precision Agriculture and Nutrient Management (3.0 cr)
•AGRO 2402 - The Science of Cannabis (2.0 cr)
•SOIL 3416 - Plant Nutrients in the Environment (3.0 cr)
or ESPM 3612W - Soil and Environmental Biology [WI] (4.0 cr)
•**Directed Study & Directed Research**
Directed Study
HORT 3093 - Directed Study (1.0 - 4.0 cr)
or AGRO 3093 - Directed Study (1.0 - 4.0 cr)
or PLSC 3093 - Directed Study (1.0 - 4.0 cr)
or FDSY 3093 - Directed Study (1.0 - 4.0 cr)
or PLPA 3993 - Directed Study (1.0 - 4.0 cr)
or **Directed Research**
HORT 3094 - Directed Research (1.0 - 4.0 cr)
or AGRO 3094 *{Inactive}*(1.0 - 4.0 cr)
or PLSC 3094 - Directed Research (1.0 - 4.0 cr)
or FDSY 3094 - Directed Research (1.0 - 4.0 cr)
or ENT 3294 - Directed Research in Entomology (1.0 - 4.0 cr)

Nursery & Floriculture

In consultation with their faculty mentor, students develop a nursery & floriculture track consisting of at least 24 credits, with a minimum of 15 credits at the 3xxx-level or above. Of these 24 credits, students need to take a minimum of 12 credits of Agro, Ent, Hort, PLSC, or

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PlPa designators.

Nursery & Floriculture

Take 24 or more credit(s) from the following:

- HORT 4141W - Scheduling Crops for Protected Environments [WI] (4.0 cr)
- HORT 5031 *{Inactive}*(3.0 cr)
- FNRM 3501 - Arboriculture: Selection and Maintenance of Trees (3.0 cr)
- PLPA 2001 - Introductory Plant Pathology (3.0 cr)
- HORT 5023 - Public Garden Management (2.0 cr)
- HORT 4461 - Horticultural Marketing (3.0 cr)
- HORT 1113 - Floral Design (3.0 cr)
- AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3.0 cr)
- PLSC 3002 - Seed Science, Technology, and Society (2.0 cr)
- HORT 1003 - Organic Gardening: From Balconies to Backyards (3.0 cr)
- HORT 1014 - The Edible Landscape [TS] (3.0 cr)
- HORT 1031 - Vines and Wines: Introduction to Viticulture and Enology (3.0 cr)
- ENT 4251 - Forest and Shade Tree Entomology (3.0 cr)
- PLPA 3003 - Diseases of Forest and Shade Trees (3.0 cr)
- HORT 5012 *{Inactive}*(3.0 cr)
- LA 1201 - Learning from the Landscape [AH, DSJ] (3.0 cr)
- LA 1301 - Introduction to Landscape Architecture Drawing [AH] (3.0 cr)
- LA 3501 - Environmental Design and Its Biological and Physical Context [ENV] (3.0 cr)
- AGRO 2402 - The Science of Cannabis (2.0 cr)
- SOIL 3416 - Plant Nutrients in the Environment (3.0 cr)

  or ESPM 3612W - Soil and Environmental Biology [WI] (4.0 cr)
- **Directed Study & Directed Research**

  Directed Study

  HORT 3093 - Directed Study (1.0 - 4.0 cr)
  or AGRO 3093 - Directed Study (1.0 - 4.0 cr)
  or PLSC 3093 - Directed Study (1.0 - 4.0 cr)
  or FDSY 3093 - Directed Study (1.0 - 4.0 cr)
  or PLPA 3993 - Directed Study (1.0 - 4.0 cr)

  or **Directed Research**

  HORT 3094 - Directed Research (1.0 - 4.0 cr)
  or AGRO 3094 *{Inactive}*(1.0 - 4.0 cr)
  or PLSC 3094 - Directed Research (1.0 - 4.0 cr)
  or FDSY 3094 - Directed Research (1.0 - 4.0 cr)
  or ENT 3294 - Directed Research in Entomology (1.0 - 4.0 cr)

Turfgrass Science

In consultation with their faculty mentor, students develop a turfgrass science track consisting of at least 24 credits, with a minimum of 15 credits at the 3xxx-level or above. Of these 24 credits, students need to take a minimum of 12 credits of Agro, Ent, Hort, PLSC, or PlPa designators.

Turfgrass Science

Take 24 or more credit(s) from the following:

- HORT 4061W - Turfgrass Management [WI] (3.0 cr)
- HORT 4062 - Turfgrass Weed and Disease Science (3.0 cr)
- HORT 4063 - Turfgrass Science (3.0 cr)
- PLPA 2001 - Introductory Plant Pathology (3.0 cr)
- AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3.0 cr)
- PLSC 3002 - Seed Science, Technology, and Society (2.0 cr)
- HORT 1061 - The Sustainable Lawn (3.0 cr)
- SOIL 4111 - Introduction to Precision Agriculture (3.0 cr)
- PLPA 3003 - Diseases of Forest and Shade Trees (3.0 cr)
- SOIL 3416 - Plant Nutrients in the Environment (3.0 cr)
- LA 1201 - Learning from the Landscape [AH, DSJ] (3.0 cr)
- LA 3501 - Environmental Design and Its Biological and Physical Context [ENV] (3.0 cr)
- AGRO 2402 - The Science of Cannabis (2.0 cr)
- **Directed Study & Directed Research**

  Directed Study

  HORT 3093 - Directed Study (1.0 - 4.0 cr)
  or AGRO 3093 - Directed Study (1.0 - 4.0 cr)
  or PLSC 3093 - Directed Study (1.0 - 4.0 cr)
  or FDSY 3093 - Directed Study (1.0 - 4.0 cr)
  or PLPA 3993 - Directed Study (1.0 - 4.0 cr)

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or **Directed Research**
HORT 3094 - Directed Research (1.0 - 4.0 cr)
or AGRO 3094 *{Inactive}*(1.0 - 4.0 cr)
or PLSC 3094 - Directed Research (1.0 - 4.0 cr)
or FDSY 3094 - Directed Research (1.0 - 4.0 cr)
or ENT 3294 - Directed Research in Entomology (1.0 - 4.0 cr)

Sustainable Plant Health

In consultation with their faculty mentor, students develop a sustainable plant health track consisting of at least 24 credits, with a minimum of 15 credits at the 3xxx-level or above. Of these 24 credits, students need to take a minimum of 12 credits of Agro, Ent, Hort, PLSC, or PlPa designators.

Sustainable Plant Health
Take 24 or more credit(s) from the following:
- ENT 1005 - Insect Biology with Lab [BIOL] (4.0 cr)
- PLPA 3003 - Diseases of Forest and Shade Trees (3.0 cr)
- AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3.0 cr)
- ENT 5341 - Biological Control of Insects and Weeds (3.0 cr)
- PLPA 5660 - Plant Disease Resistance and Applications (3.0 cr)
- ENT 3925 *{Inactive}*(3.0 cr)
- HORT 1014 - The Edible Landscape [TS] (3.0 cr)
- ENT 4251 - Forest and Shade Tree Entomology (3.0 cr)
- HORT 1061 - The Sustainable Lawn (3.0 cr)
- AGRO 2502 - Introduction to Integrated Weed Management (1.0 cr)
- LA 1001 *{Inactive}*[ENV] (3.0 cr)
- LA 1201 - Learning from the Landscape [AH, DSJ] (3.0 cr)
- LA 1401 - The Designed Environment [AH] (3.0 cr)
- LA 3003 - Climate Change Adaptation (3.0 cr)
- LA 3501 - Environmental Design and Its Biological and Physical Context [ENV] (3.0 cr)
- SOIL 4111 - Introduction to Precision Agriculture (3.0 cr)
- LAAS 5416 - Precision Agriculture and Nutrient Management (3.0 cr)
- AGRO 2402 - The Science of Cannabis (2.0 cr)
- PLPA 2001 - Introductory Plant Pathology (3.0 cr)
  or PLPA 5480 - Principles of Plant Pathology (3.0 cr)
- SOIL 3416 - Plant Nutrients in the Environment (3.0 cr)
  or ESPM 3612W - Soil and Environmental Biology [WI] (4.0 cr)
- **Directed Study & Directed Research**

Directed Study
HORT 3093 - Directed Study (1.0 - 4.0 cr)
or AGRO 3093 - Directed Study (1.0 - 4.0 cr)
or PLSC 3093 - Directed Study (1.0 - 4.0 cr)
or FDSY 3093 - Directed Study (1.0 - 4.0 cr)
or PLPA 3993 - Directed Study (1.0 - 4.0 cr)

or **Directed Research**
HORT 3094 - Directed Research (1.0 - 4.0 cr)
or AGRO 3094 *{Inactive}*(1.0 - 4.0 cr)
or PLSC 3094 - Directed Research (1.0 - 4.0 cr)
or FDSY 3094 - Directed Research (1.0 - 4.0 cr)
or ENT 3294 - Directed Research in Entomology (1.0 - 4.0 cr)

Agronomy Production

In consultation with their faculty mentor, students develop an agronomy production track consisting of at least 24 credits, with a minimum of 15 credits at the 3xxx-level or above. Of these 24 credits, students need to take a minimum of 12 credits of Agro, Ent, Hort, PLSC, or PlPa designators.

Agronomy Production
Take 24 or more credit(s) from the following:
- AGRO 1103 - Crops, Environment, and Society [ENV] (4.0 cr)
- AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3.0 cr)
- AGRO 4605 - Strategies for Agricultural Production and Management (3.0 cr)
- ENT 1005 - Insect Biology with Lab [BIOL] (4.0 cr)
- PLPA 2001 - Introductory Plant Pathology (3.0 cr)
- SOIL 3416 - Plant Nutrients in the Environment (3.0 cr)
- SOIL 4111 - Introduction to Precision Agriculture (3.0 cr)
- HORT 4141W - Scheduling Crops for Protected Environments [WI] (4.0 cr)
- AGRO 2022 - Growth and Development of Minnesota Field Crops (1.0 cr)

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•HORT 1014 - The Edible Landscape [TS] (3.0 cr)
•PLSC 3002 - Seed Science, Technology, and Society (2.0 cr)
•CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
•CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
•AGRO 2501 - Plant Identification for Urban and Rural Landscapes (1.0 cr)
•AGRO 3305 - Agroecosystems of the world [GP] (3.0 cr)
•AGRO 2502 - Introduction to Integrated Weed Management (1.0 cr)
•LAAS 5416 - Precision Agriculture and Nutrient Management (3.0 cr)
•AGRO 2402 - The Science of Cannabis (2.0 cr)
•SOIL 3416 - Plant Nutrients in the Environment (3.0 cr)
or ESPM 3612W - Soil and Environmental Biology [WI] (4.0 cr)
•**Directed Study & Directed Research**
Directed Study
HORT 3093 - Directed Study (1.0 - 4.0 cr)
or AGRO 3093 - Directed Study (1.0 - 4.0 cr)
or PLSC 3093 - Directed Study (1.0 - 4.0 cr)
or FDSY 3093 - Directed Study (1.0 - 4.0 cr)
or PLPA 3993 - Directed Study (1.0 - 4.0 cr)
or **Directed Research**
HORT 3094 - Directed Research (1.0 - 4.0 cr)
or AGRO 3094 *{Inactive}*(1.0 - 4.0 cr)
or PLSC 3094 - Directed Research (1.0 - 4.0 cr)
or FDSY 3094 - Directed Research (1.0 - 4.0 cr)
or ENT 3294 - Directed Research in Entomology (1.0 - 4.0 cr)

Integrated Plant Science BS/MS Applied Plant Science - Plant Breeding

Sub-plan catalog description: CFANS offers an integrated bachelor of science (BS) in plant science and master's of science (MS) in applied plant sciences (plant breeding and molecular genetics track). The integrated BS/MS program offers students the opportunity to earn both degrees in five years by working toward a master's degree while simultaneously working toward their undergraduate degree. Plant science undergraduate students in the plant breeding and genetics sub-plan are welcome to apply to this program during their 3rd year of undergraduate study. During the 4th year, students take undergraduate and graduate courses concurrently and are advised by an undergraduate and graduate program advisor. Students must complete undergraduate degree requirements before the end of their fourth year.

If the student does not pursue or complete the applied plant sciences MS degree portion of the integrated plant science BS/MS applied plant science - plant breeding track, their sub-plan will revert to plant breeding.

Students in this program will complete the 120 undergraduate credits required for a BS degree in plant science by the end of the 4th year and must be awarded an undergraduate degree at the 4th year mark or earlier. During the 4th and 5th years, student will complete 30 graduate credits and a Plan A or B research project with a final oral defense as required for the applied plant sciences MS degree. Student cannot double count credits to meet credit requirements for both the undergraduate and graduate degrees.

Chemistry
These 3 chemistry courses are required:
CHEM 1062 - Chemical Principles II [PHYS] (3.0 cr)
CHEM 1066 - Chemical Principles II Laboratory [PHYS] (1.0 cr)
CHEM 2301 - Organic Chemistry I (3.0 cr)
Electives
Take 17 or more credit(s) from the following:
•AGRO 3660 - Plant Genetic Resources: Identification, Conservation, and Utilization (3.0 cr)
•AGRO 4888 - Issues in Sustainable Agriculture (2.0 cr)
•AGRO 5021 - Plant Breeding Principles (3.0 cr)
•AGRO 5431 - Applied Plant Genomics and Bioinformatics (3.0 cr)
•EEB 5042 - Quantitative Genetics (3.0 cr)
•GCD 4034 - Molecular Genetics and Genomics (3.0 cr)
•HORT 4071W - Applications of Biotechnology to Plant Improvement [WI] (3.0 cr)
•HORT 5058 *{Inactive}*(3.0 cr)
•PLPA 2001 - Introductory Plant Pathology (3.0 cr)
•PLPA 5301 - Large Scale Omic Data in Plant Biology (3.0 cr)
•CSCI 1913 - Introduction to Algorithms, Data Structures, and Program Development (4.0 cr)
•AGRO 2402 - The Science of Cannabis (2.0 cr)
•**Directed Studies & Directed Research**
Directed Study
HORT 3093 - Directed Study (1.0 - 4.0 cr)
or AGRO 3093 - Directed Study (1.0 - 4.0 cr)
or PLSC 3093 - Directed Study (1.0 - 4.0 cr)

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or FDSY 3093 - Directed Study (1.0 - 4.0 cr)
or PLPA 3993 - Directed Study (1.0 - 4.0 cr)
or **Directed Research**
HORT 3094 - Directed Research (1.0 - 4.0 cr)
or AGRO 3094 *{Inactive}*(1.0 - 4.0 cr)
or PLSC 3094 - Directed Research (1.0 - 4.0 cr)
or FDSY 3094 - Directed Research (1.0 - 4.0 cr)
or ENT 3294 - Directed Research in Entomology (1.0 - 4.0 cr)

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