PLANT SCIENCES, B.S.

Begin Campus: Any Penn State Campus
End Campus: University Park

Degree Requirements
For the Bachelor of Science degree in Plant Sciences, a minimum of 120 credits are required:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Electives</td>
<td>0-13</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>83-102</td>
</tr>
</tbody>
</table>

21-24 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses; 3 credits of GS courses and 3 credits of GWS courses; plus 3 GH in Crop Production.

General Education
Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required.)
- Quantification (GQ): 6 credits
- Writing and Speaking (GWS): 9 credits

Knowledge Domains
- Arts (GA): 6 credits
- Health and Wellness (GHW): 3 credits
- Humanities (GH): 6 credits
- Social and Behavioral Sciences (GS): 6 credits
- Natural Sciences (GN): 9 credits

Integrative Studies (may also complete a Knowledge Domain requirement)
- Inter-Domain or Approved Linked Courses: 6 credits

University Degree Requirements
First Year Engagement
All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement
6 credits are required and may satisfy other requirements
- United States Cultures: 3 credits
- International Cultures: 3 credits

Writing Across the Curriculum
3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits
A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work
Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition
The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80)). For more information, check the Suggested Academic Plan for your intended program.

Requirements for the Major
To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44).

Common Requirements for the Major (All Options)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 110</td>
<td>Biology: Basic Concepts and Biodiversity</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 110</td>
<td>Chemical Principles I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 111</td>
<td>Experimental Chemistry I</td>
<td>1</td>
</tr>
<tr>
<td>ENT 313</td>
<td>Introduction to Entomology</td>
<td>2</td>
</tr>
<tr>
<td>PLANT 200</td>
<td>Introduction to Agricultural Crop Growth, Form, and Function</td>
<td>3</td>
</tr>
</tbody>
</table>

Prescribed Courses: Require a grade of C or better

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGECO 457</td>
<td>Principles of Integrated Pest Management</td>
<td>3</td>
</tr>
<tr>
<td>PLANT 461</td>
<td>Emerging Issues in Plant Sciences</td>
<td>3</td>
</tr>
<tr>
<td>SOILS 101</td>
<td>Introductory Soil Science</td>
<td>3</td>
</tr>
</tbody>
</table>

Additional Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENT 314</td>
<td>Management of Insect Pests of Ornamentals</td>
<td>1</td>
</tr>
</tbody>
</table>
Select 3 credits from the following:  
AGBM 101  Economic Principles of Agribusiness Decision Making  
ECON 14  Principles of Economics  
ECON 102  Introductory Microeconomic Analysis and Policy  
ECON 104  Introductory Macroeconomic Analysis and Policy

Select 1 credit from the following:  
AGECO 496  Agroecology Internship  
AGRO 495  Internship  
HORT 495  Internship  
HORT 496  Independent Studies

Additional Courses: Require a grade of C or better  
ENGL 202C  Effective Writing: Technical Writing  
or  ENGL 202D  Effective Writing: Business Writing

Select 3-5 credits from the following:  
MATH 22  College Algebra II and Analytic Geometry  
MATH 26  Plane Trigonometry  
MATH 40  Algebra, Trigonometry, and Analytic Geometry  
MATH 41  Trigonometry and Analytic Geometry  
MATH 110  Techniques of Calculus I  
MATH 111  Techniques of Calculus II  
MATH 140  Calculus With Analytic Geometry I  
MATH 141  Calculus with Analytic Geometry II  
MATH 141B  Calculus and Biology II

Select 3-4 credits from the following:  
STAT 200  Elementary Statistics  
STAT 240  Introduction to Biometry  
STAT 250  Introduction to Biostatistics

Requirements for the Option  
Select an Option  47-63

Requirements for the Option  
Agroecology Option (57-58 credits)

Prescribed Courses  
AGECO 295  Agroecology Internship  1  
AGECO/AGRO 438  Principles of Weed Management  4  
AGRO 423  Forage Crop Management  3  
AGRO 425  Field Crop Management  3  
HORT 407  Plant Breeding  3  
PPEM 405  Microbe-Plant Interactions: Plant Disease and Biological Control  3  
SOILS 102  Introductory Soil Science Laboratory  1  
SOILS 401  Soil Composition and Physical Properties  3  
SOILS 402  Soil Nutrient Behavior and Management  3

Prescribed Courses: Require a grade of C or better  
AGECO 201  Introductory Agroecology  3

Additional Courses  
BIOL 222  Genetics  3  
or  HORT 407  Plant Breeding

Select 3 credits from the following:  
AGECO 134  
AGECO 144  Principles and Practices of Organic Agriculture  
AGECO 154  Principles of Agronomic Field Operations

Crop Production Option (58-60 credits)  

Prescribed Courses  
AGECO 295  Agroecology Internship  1  
AGECO 429  Crop Scouting  2  
AGECO/AGRO 438  Principles of Weed Management  4  
AGRO 423  Forage Crop Management  3  
AGRO 425  Field Crop Management  3  
HORT 407  Plant Breeding  3  
PPEM 405  Microbe-Plant Interactions: Plant Disease and Biological Control  3  
SOILS 102  Introductory Soil Science Laboratory  1  
SOILS 401  Soil Composition and Physical Properties  3  
SOILS 402  Soil Nutrient Behavior and Management  3

Prescribed Courses: Require a grade of C or better  
AGECO 429  Crop Scouting  2

Additional Courses  
AGECO 154  Principles of Agronomic Field Operations  2  
or  SOILS 403  Soil Morphology Practicum

Select 3 credits from the following:  
AG 160  Introduction into Ethics and Issues in Agriculture  
PHIL 13  Nature and Environment  
PHIL 103  Ethics  
PHIL 132/  BIOET 100  Bioethics
Select 3 credits from the following:

AGBM 102  Economics of the Food System
AGBM 106  Agribusiness Problem Solving
AGBM 200  Introduction to Agricultural Business Management
AGBM 407  Farm Planning and Financial Management

Select 3 credits from the following:

AEE 201  Interpersonal Skills for Tomorrow's Leaders
AEE 360  Leadership Development for Small Groups
AEE 460  Foundations in Leadership Development
AEE 465  Leadership Practices: Power, Influences, and Impact

Select 3-4 credits from the following:

AGECO/ANSC/ SOILS 418  Nutrient Management in Agricultural Systems
ANSC 201  Animal Science
GEOG 160  Mapping Our Changing World
SOILS 450  Environmental Geographic Information Systems

Select 3-4 credits from the following:

AGRO 410W  Physiology of Agricultural Crops
HORT 412W  Post-Harvest Physiology
SOILS 412W  Soil Ecology

Additional Courses: Require a grade of C or better

AGRO 28  Principles of Crop Management
or HORT 101  Horticultural Science

Supporting Courses and Related Areas
Select 9 credits of supporting courses in consultation with adviser

Horticulture Option (51-54 credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>HORT 232</td>
<td>Horticultural Systematics</td>
<td>3</td>
</tr>
<tr>
<td>HORT 402W</td>
<td>Plant Nutrition</td>
<td>3</td>
</tr>
<tr>
<td>HORT 407</td>
<td>Plant Breeding</td>
<td>3</td>
</tr>
<tr>
<td>HORT 445</td>
<td>Plant Ecology</td>
<td>3</td>
</tr>
<tr>
<td>HORT 455</td>
<td>Retail Horticulture Business Management</td>
<td>3</td>
</tr>
</tbody>
</table>

Prescribed Courses: Require a grade of C or better

HORT 101  Horticultural Science
HORT 202  Plant Propagation
HORT 315  Environmental Effects on Horticultural Crops
HORT 412W  Post-Harvest Physiology

Additional Courses

AGRO 438  Principles of Weed Management
or HORT 238  Turf and Ornamental Weed Control
PPEM 300  Horticultural Crop Diseases
or PPEM 405  Microbe-Plant Interactions: Plant Disease and Biological Control

Select 3 credits from the following:

HORT 131  Herbaceous Perennial and Annual Identification
HORT 137  Ornamental Plant Materials
HORT 138  Ornamental Plant Materials
HORT 431  Small Fruit Culture
HORT 432  Deciduous Tree Fruits
HORT 433  Vegetable Crops

Select 6-7 credits from the following:

HORT 408  Landscape Plant Establishment and Maintenance
HORT 431  Small Fruit Culture
HORT 432  Deciduous Tree Fruits
HORT 433  Vegetable Crops
HORT 453  Flower Crop Production and Management

Select 9-10 credits from the following:

AG 301  Finance
BA 301  Finance
BA 303  Marketing
BLAW 243  Legal Environment of Business
SPAN 1  Elementary Spanish I
SPAN 2  Elementary Spanish II
SPAN 3  Intermediate Spanish
SPAN 105  Elementary Spanish I for Students in the Agricultural Sciences

1 Students cannot use the same course more than once as an additional course

Plant Genetics and Biotechnology Option (56-63 credits)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>AGRO 410W</td>
<td>Physiology of Agricultural Crops</td>
<td>4</td>
</tr>
<tr>
<td>AGRO/BIOTC 460  Advances and Applications of Plant Biotechnology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>BIOL 222</td>
<td>Genetics</td>
<td>3</td>
</tr>
<tr>
<td>BMB 400</td>
<td>Molecular Biology of the Gene</td>
<td>2-3</td>
</tr>
<tr>
<td>CHEM 112</td>
<td>Chemical Principles II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 210</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 212</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>HORT 407</td>
<td>Plant Breeding</td>
<td>3</td>
</tr>
<tr>
<td>HORT/BIOL/ BIOTC 459  Plant Tissue Culture and Biotechnology</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>PHYS 250</td>
<td>Introductory Physics I</td>
<td>4</td>
</tr>
</tbody>
</table>

Prescribed Courses: Require a grade of C or better

PPEM 405  Microbe-Plant Interactions: Plant Disease and Biological Control

Additional Courses

AGRO 28  Principles of Crop Management
or HORT 101  Horticultural Science
CHEM 113  Experimental Chemistry II
or CHEM 113B Experimental Chemistry II–Bioscience

Select 4-6 credits from the following:

BIOL 230W  Biology: Molecules and Cells
BIOL 240W  Biology: Function and Development of Organisms
BMB 211  Elementary Biochemistry
& BMB 212 and Elementary Biochemistry Laboratory
MICRB 201  Introductory Microbiology
& MICRB 202 and Introductory Microbiology Laboratory
MICRB 251/BMB 251 & MICRB 252/BMB 252

Select 3-4 credits from the following:

BIOL 414  Taxonomy of Seed Plants
Biological Sciences, B.S.

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<tr>
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<tr>
<td>BIOL 427</td>
<td>Evolution</td>
<td></td>
</tr>
<tr>
<td>BIOL 428</td>
<td>Population Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOL 436</td>
<td>Population Ecology and Global Climate Change</td>
<td></td>
</tr>
<tr>
<td>BIOL 448</td>
<td>Ecology of Plant Reproduction</td>
<td></td>
</tr>
<tr>
<td>ENT 420</td>
<td>Introduction to Population Dynamics</td>
<td></td>
</tr>
<tr>
<td>HORT 445</td>
<td>Plant Ecology</td>
<td></td>
</tr>
<tr>
<td>PPEM/Biol</td>
<td>Biology of Fungi</td>
<td>4</td>
</tr>
<tr>
<td>425</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Select 2-3 credits from the following: 2-3

- BIOL 439  | Practical Bioinformatics                              |         |
- BIOTC 479 | Methods in Biofermentations                           |         |
- HORT 497  | Special Topics                                        |         |
- MCIBS 571 | Current Issues in Biotechnology                      |         |
- MCIBS 593 | Molecular Biology Laboratory                          |         |

Select 3-4 credits from the following: 3-4

- ENT/VBSC 402W | Biology of Animal Parasites                         |         |
- ENT 410     | Insect Structure and Function                        |         |
- PPEM 416    | Plant Virology: Molecules to Populations              |         |
- PPEM/Biol 425 | Biology of Fungi                                    |         |

Select 3-4 credits from the following: 3-4

- BIOL 407   | Plant Developmental Anatomy                          |         |
- BIOL 424   | Seeds of Change: The Uses of Plants                  |         |
- BIOL 441   | Plant Physiology                                     |         |
- HORT 402W  | Plant Nutrition                                      |         |
- HORT 412W  | Post-Harvest Physiology                              |         |
- HORT 420   |                                                        |         |
- MCIBS 591  | Ethics, Rigor, Reproducibility and Conduct of Research in the Life Sciences | 2       |
- PPEM 417W  | Mechanisms of Bacterial Pathogenesis in Plants       | 1       |
- PPEM/ERM 430 | Air Pollution Impacts to Terrestrial Ecosystems     |         |

Select 3 credits from the following: 3

- AGRO 423   | Forage Crop Management                               |         |
- AGRO 425   | Field Crop Management                                 |         |
- HORT 202   | Plant Propagation                                     |         |
- HORT 315   | Environmental Effects on Horticultural Crops         |         |
- HORT 431   | Small Fruit Culture                                   |         |
- HORT 432   | Deciduous Tree Fruits                                 |         |
- HORT 433   | Vegetable Crops                                       |         |
- SOILS/AGECO/ANSC 418 | Nutrient Management in Agricultural Systems |         |

Plant Science Option (47-53 credits)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Prescribed Courses</td>
<td></td>
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</tr>
<tr>
<td>BIOL 222</td>
<td>Genetics</td>
<td>3</td>
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<td>Chemical Principles II</td>
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<td>CHEM 210</td>
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</tr>
<tr>
<td>CHEM 212</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 213</td>
<td>Laboratory in Organic Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>PHYS 250</td>
<td>Introductory Physics I</td>
<td>4</td>
</tr>
</tbody>
</table>

Prescribed Courses: Require a grade of C or better

- PPEM 405 | Microbe-Plant Interactions: Plant Disease and Biological Control | 3       |

Additional Courses

<table>
<thead>
<tr>
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<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRO 28</td>
<td>Principles of Crop Management</td>
<td>3</td>
</tr>
<tr>
<td>or HORT 101</td>
<td>Horticultural Science</td>
<td></td>
</tr>
<tr>
<td>CHEM 113</td>
<td>Experimental Chemistry II</td>
<td>1</td>
</tr>
<tr>
<td>or CHEM 113B</td>
<td>Experimental Chemistry II--Bioscience</td>
<td></td>
</tr>
</tbody>
</table>

Select 4-6 credits of the following: 4-6

- BMB 211   | Elementary Biochemistry                                 |         |
- BMB 212   | and Elementary Biochemistry Laboratory                  |         |
- BIOL 230W | Biology: Molecules and Cells                            |         |
- BIOL 240W | Biology: Function and Development of Organisms          |         |
- MICRB 201 | Introductory Microbiology                               |         |
- & MICRB 202 | and Introductory Microbiology Laboratory               |         |
- MICRB 251 | Molecular and Cell Biology I                            |         |
- MICRB 252 | Molecular and Cell Biology II                           |         |

Select 3-4 credits of the following: 3-4

- BIOL 439  | Practical Bioinformatics                               | 1       |
- BIOL 441  | Plant Physiology                                       | 1       |
- HORT 407  | Plant Breeding                                         | 1       |
- HORT 412W | Post-Harvest Physiology                                | 1       |

Select 3 credits of the following: 3

- AGRO 460 | Advances and Applications of Plant Biotechnology       |         |
- BIOL 439 | Practical Bioinformatics                               |         |
- HORT 407 | Plant Breeding                                         | 1       |
- HORT 459 | Plant Tissue Culture and Biotechnology                 |         |

Select 6-7 credits of the following: 6-7

- AGRO 410W | Physiology of Agricultural Crops                      |         |
- AGRO 460 | Advances and Applications of Plant Biotechnology       |         |
- BIOL 407  | Plant Developmental Anatomy                            |         |
- BIOL 441  | Plant Physiology                                       |         |
- BIOL 424  | Seeds of Change: The Uses of Plants                    |         |
- HORT 402W | Plant Nutrition                                       |         |
- HORT 407  | Plant Breeding                                         | 1       |
- HORT 412W | Post-Harvest Physiology                                |         |
- HORT 420  |                                                        |         |
- PPEM 417W | Mechanisms of Bacterial Pathogenesis in Plants         | 1       |
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPEM/ERM 430</td>
<td>Air Pollution Impacts to Terrestrial Ecosystems</td>
<td>3-4</td>
</tr>
<tr>
<td>AGRO 410W</td>
<td>Physiology of Agricultural Crops</td>
<td></td>
</tr>
<tr>
<td>HORT 412W</td>
<td>Post-Harvest Physiology</td>
<td></td>
</tr>
<tr>
<td>SOILS 412W</td>
<td>Soil Ecology</td>
<td></td>
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