### Applied Plant Sciences M.S. Program Requirements

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<th>M.S. Requirements</th>
<th>Agronomy/Agroecology Track</th>
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<tr>
<td><strong>Course</strong></td>
<td><strong>Title</strong></td>
</tr>
<tr>
<td>APSC 8123</td>
<td>Research Ethics in the Plant and Environmental Sciences</td>
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<tr>
<td>Agro 5311</td>
<td>Research Methods in Crop Improvement and Production</td>
</tr>
<tr>
<td>Agro/Hort 8270</td>
<td>Graduate Seminar</td>
</tr>
<tr>
<td>Stat 5021 or NR 5021</td>
<td>Statistical Analysis or Statistics for Agriculture and Natural Resource Professionals</td>
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</tbody>
</table>

Area: Agronomy/Agroecology
Plan A and Plan B: at least 2 courses; See list

Area: Plant Biology
Plan A and Plan B: at least 1 course; See list

Area: Additional Courses
Determined by student/committee - See list

**Total Course Credits (Plan A)** > 20
**Total Course Credits (Plan B)** > 30

**APSC 8777** Thesis Credits (Plan A only) 10

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**Plan A** requires 20 coursework credits and 10 thesis credits. The final exam is oral.

**Plan B** requires 30 major credits and 0 credits outside the major. The final exam is oral. A capstone project, which is determined in consultation with the student's adviser, is required. This program may be completed with a minor.

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 1 semester must be completed before filing a Degree Program Form.

Students are required to complete the courses in the common curriculum and the requirements for their specialization, and to present one graduate seminar. Additional course requirements are flexible and are determined in consultation with the student's adviser(s) and advisory committee. Required core courses are counted toward the required credits.

**Required courses**
All APS graduate students are required to take the following core courses:
- AGRO 5311 - Research Methods in Crop Improvement and Production (1.0 cr)
- AGRO 8270 - Graduate Seminar (1.0 cr)
- APSC 8123 - Research Ethics in the Plant and Environmental Sciences (0.5 cr)
- STAT 5021 - Statistical Analysis (4.0 cr)
  or NR 5021 Statistics for Agriculture and Natural Resource Professionals (3 cr), Fall
M.S. Plan A degree: In addition to the 6.5 credits in program-wide required courses, students must complete 14 credits including the following:

**Two agroecology/agronomy courses:**
- AGRO 4005 - Applied Crop Physiology and Development (4 cr)
- AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3 cr)
- AGRO 4605 – Strategies for Agricultural Production and Management (3 cr)
- AGRO 4401 - Plant Genetics and Breeding (4 cr)
- AGRO 5021 – Plant Breeding Principles (3 cr), Fall
- AGRO 4888 – Issues in Sustainable Agriculture (2 cr)
- SAGR 8010 - Sustainable Agriculture Colloquium (2 cr)
- AGRO 5321 - Ecology of Agricultural Systems (3 cr)
- AGRO 5999 - Special Topics: Agro-ecosystems Analysis Summer Field Course (3 cr);
- AGRO / HORT 8201 - Advanced Plant Breeding, 3 cr., Fall (odd years)
- AGRO/HORT 8280 - Current Topics in Applied Plant Sciences (1 cr)

A course in plant biology such as:
- PBIO 5516 - Plant Cell Biology (3 cr)
- PBIO 5412 - Plant Physiology (3 cr)
- PBIO 5601 – Topics in Plant Biochemistry (3 cr)

At least one other course from the following suggested courses:
- BIOL 5407 - Ecology (3 cr)
- EEB 4068 - Plant Physiological Ecology (3 cr)
- EEB 5609 - Ecosystem Ecology (3 cr)
- EEB 5053 - Ecology: Theory and Concepts (4 cr)
- HORT 5071 - Restoration and Reclamation Ecology (3 cr)
- ESPM 5108 - Ecology of Managed Systems (4 cr)
- ESPM 5245 - Sustainable Land Use Planning and Policy (3 cr)
- ESPM 5295 - GIS in Environmental Science and Management 4 cr
- HORT 4071W - Applications of Biotechnology to Plant Improvement (4 cr)
- PLPA5103 - Plant Microbe Interactions 3 cr
- PLPA 5202 - Field Plant Pathology 2 cr
- PLPA 5480 - Principles of Plant Pathology 3 cr
- PLPA 5660 - Plant Disease Resistance and Applications, 3 cr
- SOIL 4111 - Introduction to Precision Agriculture 3 cr
- SOIL 5611 - Soil Biology and Fertility 3 cr

Courses listed within the agroecology/agronomy, plant biology, and ecology groups are provided as a guide for students and faculty. Other courses can be substituted with agreement of the adviser, advisory committee, and DGS.

M.S. Plan B degree: Students must complete the course requirements of the MS Plan A (above) plus 10 additional credits.
Applied Plant Sciences - Agronomy/Agroecology Track
Ph.D.

Applied Plant Sciences PhD Program Requirements

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
<th>Semester</th>
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<tr>
<td>APSC 8123*</td>
<td>Research Ethics in the Plant and Environmental Sciences (unless taken in M.S. at U of M)</td>
<td>0.5</td>
<td>Spring</td>
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<tr>
<td>Agro 5311*</td>
<td>Research Methods in Crop Improvement and Production</td>
<td>1</td>
<td>Summer (register in Fall)</td>
</tr>
<tr>
<td>Agro/Hort 8270*</td>
<td>Graduate Seminar</td>
<td>1</td>
<td>Fall &amp; Spring</td>
</tr>
<tr>
<td>Stat 5021 or NR 5021*</td>
<td>Statistical Analysis or Statistics for Agriculture and Natural Resource Professionals</td>
<td>4</td>
<td>Fall &amp; Spring or Fall</td>
</tr>
<tr>
<td>Grad 8101</td>
<td>Teaching in Higher Education</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Agro/Hort 8280 or SAGR 8010</td>
<td>Current Topics in Applied Plant Sciences Colloquium in Sustainable Agriculture</td>
<td>1</td>
<td>2</td>
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Area: Agronomy/Agroecology
Plan A and Plan B: at least 2 courses; See list

Area: Plant Biology
Plan A and Plan B: at least 1 course; See list

Area: Additional Courses
Determined by student/committee; See list

Total Course Credits > 30

APSC 8888 Thesis Credits 24

*Not required if already completed as part of M.S. program.

30 course credits are required in the major.

24 thesis credits are required.

This program may be completed with a minor in another field.

Successful completion and defense of a thesis is required for completion of the Ph.D. degree (see http://policy.umn.edu/education/doctoralcompletion).

Use of 4xxx courses toward program requirements is permitted under certain conditions with adviser approval.

A minimum GPA of 3.00 is required for students to remain in good standing.

At least 1 semester must be completed before filing a Degree Program Form.

Ph.D. students are required to complete the courses in the common curriculum (below), the requirements for their respective specialization, and present one graduate seminar (AGRO 8270) as part of their PhD program (in addition to AGRO 8270 if taken as part of a M.S. program); 24 thesis credits are also required. Additional course requirements are flexible and are determined in consultation with the student’s adviser(s) and advisory committee. Required core courses are counted toward the required 30 credits. Credits from graduate coursework at the UMN or from another institution, completed prior to admission to the PhD program, may be used subject to limitations in University policy (http://policy.umn.edu/education/gradcreditdegree).
Required courses
AGRO 5311 - Research Methods in Crop Improvement and Production (1.0 cr)
AGRO 8270 - Graduate Seminar (1.0 cr)
APSC 8123 - Research Ethics in the Plant and Environmental Sciences (0.5 cr)
GRAD 8101 - Teaching in Higher Education (3.0 cr)
AGRO/HORT 8280 - Current Topics in Applied Plant Sciences (1 cr)
STAT 5021 - Statistical Analysis (4.0 cr)
or NR 5021 Statistics for Agriculture and Natural Resource Professionals (3 cr), Fall
Note: APSC 8123, AGRO 5311 and STAT 5021 are not required if previously included in a M.S. program.

Students must complete 30 credits including the program-wide required courses and courses from the following areas:

Two agroecology/agronomy courses:
AGRO 4005 - Applied Crop Physiology and Development (4 cr)
AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3 cr)
AGRO 4605 – Strategies for Agricultural Production and Management (3 cr)
AGRO 4401 - Plant Genetics and Breeding (4 cr)
AGRO 5021 – Plant Breeding Principles (3 cr), Fall
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