Applied Plant Sciences – Horticulture Track
M.S.

Applied Plant Sciences M.S. Program Requirements

<table>
<thead>
<tr>
<th>M.S. Requirements</th>
<th>Horticulture Track</th>
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</thead>
<tbody>
<tr>
<td>Course</td>
<td>Title</td>
</tr>
<tr>
<td>APSC 8123</td>
<td>Research Ethics in the Plant and Environmental Sciences</td>
</tr>
<tr>
<td>Agro 5311</td>
<td>Research Methods in Crop Improvement and Production</td>
</tr>
<tr>
<td>APSC 8270</td>
<td>Graduate Seminar</td>
</tr>
<tr>
<td>Stat 5021 or NR 5021 or Agro 5121</td>
<td>Statistical Analysis or Statistics for Agriculture and Natural Resource Professionals</td>
</tr>
<tr>
<td>Area 1</td>
<td>Plan A: 1 course; Plan B: 2 courses; See list</td>
</tr>
<tr>
<td>Area 2</td>
<td>Plan A: 1 course; Plan B: 2 courses; See list</td>
</tr>
<tr>
<td>Area 3</td>
<td>Determined by student/committee - See list</td>
</tr>
<tr>
<td>Additional Courses</td>
<td>Determined by student/committee</td>
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</tbody>
</table>

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

APSC 8777 Thesis Credits (Plan A only) 10

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

Plan B requires 30 coursework credits. The final exam is oral. A capstone project, which is determined in consultation with the student’s advisor, is required.

Plan A or Plan B 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.

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 MS graduate students are required to take a group of core courses
AGRO 5311 - Research Methods in Crop Improvement and Production (1.0 cr)
APSC 8270 - Graduate Seminar (1.0 cr)
APSC 8123 - Research Ethics in the Plant and Environmental Sciences (0.5 cr)
NR 5021 – Statistics for Agriculture and Natural Resource Professionals, 3 cr., Fall or STAT 5021 – Statistical Analysis, 4 cr., Fall & Spring
or Agro 5121
MS Plan A degree: students must complete the 6.5 credits in program-wide required courses plus 14 credits in Areas 1, 2, and 3; must complete at least one course in Area 1 and at least one course in Area 2

MS Plan B degree: students must complete the 6.5 credits in program-wide required courses plus 24 credits in Areas 1, 2, and 3; must complete at least two courses in Area 1 and at least two courses in Area 2

**Area 1 - Cross Commodity Horticulture**
- HORT 4071W - Applications of Biotechnology to Plant Improvement (4 cr)
- AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3 cr)
- HORT 4461 - Horticultural Marketing
- HORT 4850 - Pollinator Protection in Managed Landscapes
- HORT 5007 - Advanced Plant Propagation (3 cr) (Sp even yrs)
- HORT 5023 - Public Garden Management (2 cr)
- AGRO 5321 - Ecology of Agricultural Systems (3 cr)
- MKTG 6051 - Marketing Research (4 cr)
- MKTG 6055 - Buyer Behavior (4 cr)
- MKTG 6082 – Brand Management
- MBA 6210 - Marketing Management (3 cr)
- SAGR 8010 - Colloquium in Sustainable Agriculture (2 cr)
- AGRO/HORT - 8280 - Current Topics in Applied Plant Sciences (1 cr)

**Area 2 - Commodity-based Horticulture**
- HORT 4061 - Turfgrass Management (4 cr)
- HORT 4063 - Turfgrass Science (3 cr) HORT 4141W - Plant Production I (4 cr)
- HORT 5011 – Common Medicinal Plants: Classification, Identification, and Application (3 cr)
- HORT 5012 – Common Medicinal Plants: Growing and Processing (3 cr)
- HORT 5031 - Viticulture and Fruit Production for Local and Organic Markets (3 cr), Fall (odd yrs)
- HORT 5032 - Organic Vegetable Production (3 cr), Spring (odd yrs)
- HORT 5061 – Advanced Turfgrass Science (2 cr)
- HORT 5071 – Ecological Restoration (3 cr)

**Area 3 – Related Fields** (Courses other than those listed below can be substituted with agreement of the adviser, advisory committee, and DGS.)
- HORT 5058 - Plant Cytogenetics (2 cr)
- HORT 5059 - Plant Cytogenetics Lab (1 cr)
- AGRO 5021 – Plant Breeding Principles (3 cr), Fall
- APSC? 8201 - Advanced Plant Breeding, 3 cr., Fall (odd years)
- APSC? 8023 - Evolution of Crop Plants 3 cr
- PBIO 5516 - Plant Cell Biology (3 cr)
- PBIO 5412 - Plant Physiology (3 cr)
- PBIO 5601 – Topics in Plant Biochemistry (3 cr)
- 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)
- 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
- 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
Applied Plant Sciences - Horticulture Track
Ph.D.

Applied Plant Sciences PhD Program Requirements

<table>
<thead>
<tr>
<th>Ph.D. Requirements</th>
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<tr>
<td><strong>Course</strong></td>
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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>
</tr>
<tr>
<td>Agro 5311</td>
<td>Research Methods in Crop Improvement and Production</td>
</tr>
<tr>
<td>APSC 8270</td>
<td>Graduate Seminar</td>
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<tr>
<td>Stat 5021 or NR 5021 or Agro 5121</td>
<td>Statistical Analysis or Statistics for Agriculture and Natural Resource Professionals</td>
</tr>
<tr>
<td>Grad 8101</td>
<td>Teaching in Higher Education</td>
</tr>
<tr>
<td>APSC 8280 or SAGR 8010</td>
<td>Current Topics in Applied Plant Sciences Colloquium in Sustainable Agriculture</td>
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<tr>
<td><strong>Area 1</strong></td>
<td>At least one course from each Area; Four courses in total from Areas 1 and 2 – see lists</td>
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<tr>
<td><strong>Area 2</strong></td>
<td>Determined by student/committee - See list</td>
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<td><strong>Area 3</strong></td>
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<td><strong>Additional Courses</strong></td>
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<tr>
<td><strong>Total Course Credits</strong></td>
<td>&gt; 30</td>
</tr>
<tr>
<td><strong>APSC 8888</strong></td>
<td>Thesis Credits</td>
</tr>
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</table>

With the exception of APSC 8270, courses are not required if previously taken in an M.S. program.

30 course credits are required.

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.

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 (APSC 8270) as part of their PhD program (in addition to APSC 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) and approval by adviser and DGS.

**REQUIRED COURSES**
All APS PhD graduate students are required to take a group of core courses

AGRO 5311 - Research Methods in Crop Improvement and Production (1.0 cr)
APSC 8270 - Graduate Seminar (1.0 cr)
APSC 8123 - Research Ethics in the Plant and Environmental Sciences (0.5 cr) unless taken in M.S. program at University of Minnesota
GRAD 8101 - Teaching in Higher Education (3.0 cr)
SAGR 8010 - Colloquium in Sustainable Agriculture (2.0 cr) OR
APSC 8280 - Current Topics in Applied Plant Sciences (1 cr)
STAT 5021 - Statistical Analysis (4.0 cr)
or NR 5021
Note: Courses are not required if previously taken in an M.S. program, except for APSC 8270.

Students in the Horticulture track must complete 30 credits including the program-wide required courses and courses from Horticulture Specialization Areas 1, 2 and 3. The program must include at least four courses from the Horticulture Specialization Areas 1 and 2 with at least one course from each area.

**Horticulture Specialization courses:**

**Area 1 - Cross Commodity Horticulture**
HORT 4071W - Applications of Biotechnology to Plant Improvement (4 cr)
AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3 cr)
HORT 4461 - Horticultural Marketing
HORT 4850 - Pollinator Protection in Managed Landscapes
HORT 5007 - Advanced Plant Propagation (3 cr) (Sp even yrs)
HORT 5023 - Public Garden Management (2 cr)
AGRO 5321 - Ecology of Agricultural Systems (3 cr)
MKTG 6051 - Marketing Research (4 cr)
MKTG 6055 - Buyer Behavior (4 cr)
MKTG 6082 – Brand Management
MBA 6210 - Marketing Management

**Area 2 - Commodity-based Horticulture**
HORT 4061 - Turfgrass Management (4 cr)
HORT 4062 - Turfgrass Weed and Disease Science (3 cr), Fall (odd yrs)
HORT 4063 - Turfgrass Science (3 cr) HORT 4141W - Plant Production I (4 cr)
HORT 5011 – Common Medicinal Plants: Classification, Identification, and Application (3 cr)
HORT 5012 – Common Medicinal Plants: Growing and Processing (3 cr)
HORT 5031 - Viticulture and Fruit Production for Local and Organic Markets (3 cr), Fall (odd yrs)
HORT 5032 - Organic Vegetable Production (3 cr), Spring (odd yrs)
HORT 5051 - Plant Production II (4 cr)
HORT 5061 – Advanced Turfgrass Science (2 cr)
HORT 5071 – Ecological Restoration (3 cr)

**Area 3 – Related Fields (Courses other than those listed below can be substituted with agreement of the adviser, advisory committee, and DGS.)**
HORT 5058 - Plant Cytogenetics (2 cr)
HORT 5059 - Plant Cytogenetics Lab (1 cr)
AGRO 5021 – Plant Breeding Principles (3 cr), Fall
APSC? 8201 - Advanced Plant Breeding, 3 cr., Fall (odd years)
APSC? 8023 - Evolution of Crop Plants 3 cr
PBIO 5516 - Plant Cell Biology (3 cr)
PBIO 5412 - Plant Physiology (3 cr)
PBIO 5601 – Topics in Plant Biochemistry (3 cr)
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)
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
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