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

<table>
<thead>
<tr>
<th>M.S. Requirements</th>
<th>Horticulture Track</th>
</tr>
</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</td>
<td>Statistical Analysis or Statistics for Agriculture and Natural Resource Professionals</td>
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<tr>
<td>NR 5021 or</td>
<td></td>
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<tr>
<td>Agro 5121</td>
<td></td>
</tr>
<tr>
<td>Or many other</td>
<td></td>
</tr>
<tr>
<td>courses to choose</td>
<td></td>
</tr>
<tr>
<td>from – check the</td>
<td></td>
</tr>
<tr>
<td>catalog online</td>
<td></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>
</tr>
<tr>
<td></td>
<td>Total Course Credits (Plan A)</td>
</tr>
<tr>
<td></td>
<td>Total Course Credits (Plan B)</td>
</tr>
<tr>
<td>APSC 8777</td>
<td>Thesis Credits (Plan A only)</td>
</tr>
</tbody>
</table>

**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.

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
AGRO 4505 - Biology, Ecology, and Management of Invasive Plants (3 cr)
AGRO 5321 - Ecology of Agricultural Systems (3 cr)
AGRO/HORT - 8280 - Current Topics in Applied Plant Sciences (1 cr)
HORT 4071W - Applications of Biotechnology to Plant Improvement (4 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)
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)

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.)
AGRO 5021 – Plant Breeding Principles (3 cr)
AGRO 8023 - Evolution of Crop Plants 3 cr
APSC 8201 - Advanced Plant Breeding, 3 cr
BIOL 5407 - Ecology (3 cr)
EEB 4068 - Plant Physiological Ecology (3 cr)
EEB 5053 - Ecology: Theory and Concepts (4 cr)
EEB 5609 - Ecosystem 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 5058 - Plant Cytogenetics (2 cr)
HORT 5059 - Plant Cytogenetics Lab (1 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
PMB 5412 - Plant Physiology (3 cr)
PMB 5516 - Plant Cell Biology (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.*
*This is only a guideline - Always check the official online catalog for the most up-to-date requirements.

Applied Plant Sciences PhD Program Requirements

<table>
<thead>
<tr>
<th>Ph.D. Requirements</th>
<th>Horticulture Track</th>
<th>Credits</th>
<th>Semester</th>
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</thead>
<tbody>
<tr>
<td>Course</td>
<td>Title</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>
<td>0.5</td>
<td>Spring</td>
</tr>
<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>APSC 8270</td>
<td>Graduate Seminar</td>
<td>2</td>
<td>Fall &amp; Spring</td>
</tr>
<tr>
<td>Stat 5021 or NR 5021 or Agro 5121 or many other courses to choose from check the catalog online</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 or CFAN 8101</td>
<td>Teaching in Higher Education Professional Skills for Scientists</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>APSC 8280 or SAGR 8010</td>
<td>Current Topics in Applied Plant Sciences Colloquium in Sustainable Agriculture</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Area 1</td>
<td>At least one course from each Area; Four courses in total from Areas 1 and 2 – see lists</td>
<td></td>
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<tr>
<td>Area 2</td>
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<td>Additional Courses</td>
<td>Determined by student/committee</td>
<td></td>
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</tbody>
</table>

| Total Course Credits | > 30 |

| APSC 8888 | Thesis Credits | 24 |

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
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 (3 cr)

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