**Applied Plant Sciences Track M.S.**

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

<table>
<thead>
<tr>
<th>M.S. Requirements</th>
<th>Applied Plant Sciences Track</th>
<th>Credits</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course</td>
<td>Title</td>
<td></td>
<td></td>
</tr>
<tr>
<td>APSC 8123</td>
<td>Research Ethics in the Plant and Environmental Sciences</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>1</td>
<td>Fall &amp; Spring</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>
<td>4</td>
<td>Fall &amp; Spring or Fall</td>
</tr>
</tbody>
</table>

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

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

Area: Cropping Systems, Communities, and Commodities  
Plan A and Plan B: at least 1 course; See list

Additional Courses  
Determined by student/committee

<table>
<thead>
<tr>
<th></th>
<th>Total Course Credits (Plan A)</th>
<th>&gt; 20</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Total Course Credits (Plan B)</td>
<td>&gt; 30</td>
</tr>
<tr>
<td>APSC 8777</td>
<td>Thesis Credits (Plan A only)</td>
<td>10</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 adviser, 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
In addition to the required courses, the degree program plan must include at least one course from each of the three areas below:

**Genetics and Plant Breeding**
- AGRO 5021 – Plant Breeding Principles (3 cr)
- HORT 5058 - Plant Cytogenetics (2 cr)
- HORT 5059 - Plant Cytogenetics Lab (1 cr)
- AGRO 5431 – Applied Plant Genomics and Bioinformatics (3 cr)
- APSC? 8023 - Evolution of Crop Plants (2 cr) Spring (even years)
- APSC? 8201 - Advanced Plant Breeding (3 cr) Fall (odd years)
- AGRO 8202 - Breeding for Quantitative Traits in Plants (3 cr) Spring (even years)
- AGRO 8241 - Chromosomal & Mol. Genetics of Plant Improvement (3 cr) Spring (odd years)
- EEB 5033 - Population and Quantitative Genetics (4 cr) Fall
- HORT 4071 - Application of Biotechnology to Plant Improvement (4 cr) Fall
- PLPA 5301 - Large Scale Omic Data in Plant Biology (3 cr) Fall
- EEB 5042 - Quantitative Genetics (3 cr) Fall
- GCD 4034 - Molecular Genetics (3 cr) Spring
- GCD 8131 - Advanced Genetics and Genomics (3 cr) Spring

**Organismal Biology**
- HORT 5007 - Advanced Plant Propagation (3 cr) Spring (even years)
- PBIO 5412 - Plant Physiology (3 cr) Fall
- PBIO 5516 - Plant Cell Biology (3 cr)
- PBIO 5601 – Topics in Plant Biochemistry (3 cr)
- PLPA 5103/8103 - Plant-Microbe Interactions (3 cr) Spring
- PLPA 5203 - Introduction to Fungal Biology (3 cr) Fall
- PLPA 5444 - Ecol, Epidem, and Evol. Biol. of Plant-Microbe Interactions (3 cr) Fall
- PLPA 5480 - Principles of Plant Pathology (3 cr) Fall
- PLPA 5660 - Plant Disease Resistance and Applications (3 cr)
- PLPA 8104 - Plant Virology (2 cr) Spring
- PLPA 8105 - Plant Bacteriology (2 cr) Spring

**Cropping Systems, Communities, and Commodities**
- AGRO 4505 - Biol., Ecology, and Manage, of Invasive Plants (3 cr) Spring
- AGRO 5321 - Ecology of Agricultural Systems (3 cr) Fall (even years)
- HORT 4061 - Turfgrass Management (3 cr) Fall
- HORT 4063 - Turfgrass Science (3 cr) Spring
- HORT 4141W - Plant Production I (4 cr) Fall
- HORT 5031 - Viticulture and Fruit Production for Local and Organic Markets (2 cr) Fall (odd years)
- HORT 5032 - Organic Vegetable Production (3 cr) Spring (odd years)
- HORT 5071 – Ecological Restoration (3 cr) Fall
- PLPA 5202 - Field Plant Pathology (2 cr)
- PLPA 5444 - Ecol, Epidem, and Evolutionary Biology of Plant-Microbe Interactions (3 cr) Fall
- SAGR 8010 - Colloquium in Sustainable Agriculture (2 cr) Fall
### Applied Plant Sciences PhD Program Requirements

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<tr>
<th>Course</th>
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<th>Semester</th>
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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>
<td>4 or 3</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>APSC 8280 or SAGR 8010</td>
<td>Current Topics in Applied Plant Sciences or Colloquium in Sustainable Agriculture</td>
<td>1 or 2</td>
<td></td>
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</tbody>
</table>

Graduate Degree Plan must include a minimum of four courses from the areas below with at least one course from each area.

| Area: Genetics and Plant Breeding | At least one course; See list |
| Area: Organismal Biology          | At least one course; See list |
| Area: Cropping Systems, Communities, and Commodities | At least one course; See list |
| Additional Courses                | Determined by student/committee |
| **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 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](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
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.

In addition to the Required Courses above, students must include a minimum of four courses from the three areas below with at least one course from each of the three areas:

Genetics and Plant Breeding
AGRO 5021 – Title (Plant Breeding – add when approved)
HORT 5058 - Plant Cytogenetics (2 cr)
HORT 5059 - Plant Cytogenetics Lab (1 cr)
AGRO 5431 – Applied Plant Genomics and Bioinformatics (3 cr)
APSC? - 8023, Evolution of Crop Plants (2 cr) Spring (even years)
APSC? - 8201, Advanced Plant Breeding (3 cr) Fall (odd years)
AGRO 8202 - Breeding for Quantitative Traits in Plants (3 cr) Spring (even years)
AGRO 8241 - Chromosomal & Mol. Genetics of Plant Improv. (3 cr) Spring (odd years)
HORT 4071 - Application of Biotechnology to Plant Improvement (4 cr) Fall
PLPA 5301- Large Scale Omic Data in Plant Biology (3 cr) Fall
EEB 5042 - Quantitative Genetics (3 cr) Fall
GCD 4034 - Molecular Genetics (3 cr), Spring
GCD 8131 - Advanced Genetics and Genomics (3 cr) Spring

Organismal Biology
HORT 5007 - Advanced Plant Propagation (3 cr) Spring (even years)
HORT 8044 - Manipulation of Plant Growth and Reproduction (2 cr) Spring (odd years)
PBIO 5412 - Plant Physiology (3 cr) Fall
PBIO 5516 - Plant Cell Biology (3 cr)
PBIO 5601 – Topics in Plant Biochemistry (3 cr)
PLPA 5103/8103 - Plant-Microbe Interactions (3 cr) Spring
PLPA 5203 - Introduction to Fungal Biology (3 cr) Fall
PLPA 5444 - Ecology, Epidemiology, and Evolutionary Biology of Plant-Microbe Interactions (3 cr) Fall
PLPA 5480 - Principles of Plant Pathology (3 cr) Fall
PLPA 5660 - Plant Disease Resistance and Applications (3 cr)
PLPA 8104 - Plant Virology (2 cr) Spring
PLPA 8105 - Plant Bacteriology (2 cr) Spring

Cropping Systems, Communities, and Commodities
AGRO 4505 - Biol., Ecology, and Manage, of Invasive Plants (3 cr) Spring
AGRO 5321 - Ecology of Agricultural Systems (3 cr) Fall (even years)
HORT 4061 - Turfgrass Management (3 cr) Fall
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HORT 5071 – Ecological Restoration (3 cr) Fall
PLPA 5202 - Field Plant Pathology (2 cr)
PLPA 5444 - Ecol, Epidem, and Evolutionary Biology of Plant-Microbe Interactions (3 cr) Fall
SAGR 8010 - Colloquium in Sustainable Agriculture (2 cr) Fall