



Applied Plant Sciences GRADUATE PROGRAM

UNIVERSITY OF MINNESOTA

http://www.appliedplantsciences.umn.edu/Applied_Plant_Sciences2.html



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The Applied Plant Sciences (APS) Graduate Program.

The APS Graduate Program was established in 1998 as a merger of the Horticulture, Agronomy, and Plant Breeding and Genetics graduate programs. Faculty APS specializations are: Agronomy/Agroecology, Horticultural Science and Plant Breeding/Molecular Genetics. Current APS graduate faculty membership is 61 from six departments across three colleges.



Agronomy/Agroecology (19 graduate faculty). Graduate students in *Agronomy/Agroecology* conduct research in cropping systems and weed science. Emphasis is on improving production efficiency, profitability in an environmentally sound approach that benefits society, mechanisms of crop physiology and ecology underlying plant responses to the environment.



Horticultural Science (17 graduate faculty). Graduate students in *Horticultural Science* conduct research related to fruits, vegetables, potatoes, flowers, ornamental trees & shrubs or turf; on the physiology, production, environmental impact of cropping systems, and use of horticultural crops.



Plant Breeding/Molecular Genetics (25 graduate faculty). Graduate students in *Plant Breeding/Molecular Genetics* conduct research ranging from applied plant breeding projects emphasizing breeding procedures and methodologies to molecular genetic projects using biotechnology, genetic engineering, and genomic methods. Students integrate the latest techniques with applications in the field to develop new germplasm that will improve the sustainability of our crop systems.

Part I. Breeding efforts by crop

Graduate faculty in the Plant Breeding/Molecular Genetics section are involved in research with crops as diverse as alfalfa, barley, common bean, flowers, forage legumes, fruit crops, maize, oats, potatoes, soybeans, turf grass, wheat, and woody landscape plants (Table 1). Crop research includes classic & molecular breeding, genetics, cytogenetics, comparative genomics, bioinformatics, functional genomics, reproductive barriers, and prevention of invasiveness.

Table 1. U of M crop group person year (PY) and crop releases.

Crop Group	PYs	Releases in the past 5 years	
		Germplasm	Cultivars
Barley	1.2	0	1
Corn	1.8	0	0
Flowers	0.5	18	9
Forage legumes & forage grasses	0.9	0	4
Fruit	0.8	0	6
Oat	1.9	0	4
Ornamental Trees & Shrubs	0.7	0	9
Soybean	1.6	0	24
Potato	0.7	0	0
Turf & Ornamental Grasses	0.95	0	5
Wheat	2.2	0	3
Total	13.25	18	65

Part II. Breeding efforts by activity. APS graduate faculty are involved in plant breeding research, germplasm enhancement, cultivar development, biotechnology R&D, and plant breeding education (Table 2). Graduate faculty teach courses and advise students.



Table 2. Breeding efforts by activity of APS graduate faculty.

Activity	PYs	%
(a) Plant Breeding Research	10.1	50.5
(b) Germplasm Enhancement	0.3	1.5
(c) Cultivar Development	3.5	17.5
(d) Biotechnology Research & Development	1.9	9.5
(e) Plant Breeding Education	4.2	21.0
Total	20.0*	100%

*Note: This does not include % extension, Professor Emeriti, etc.

Part III. Recent graduates and current graduate student enrollment.

APS has an excellent history in recruiting and retaining exceptional students. Since 2001, APS received 202 applications. A total of 87(43%) offers of acceptance were made; 75(86%) were accepted. Of these matriculated students, 47(63%) were women or minorities. Mean GRE scores of the 75 admitted APS students (2001-) was 545 (Verbal), 660 (Quantitative) with a GPA = 3.58. Two APS students were recruited on selective Graduate School Fellowships (2001-2006). During 2000-2006, there were 52 M.S. and Ph.D. student graduates from the program (Table 3). Currently, we have 22 APS students (Table 3). APS awarded 33 M.S. and 19 Ph.D. degrees in 2000-2006 with a mean Ph.D. completion time of 3.5 yrs.

Table 3. APS graduate student statistics based on country of origin and degree.

	Domestic		International	
	M.S.	Ph.D.	M.S.	Ph.D.
Graduates (2000-2006)	25	7	8	12
Students in plant breeding	3	9	4	6



Part IV. Job placement of recent graduates (Table 4)

Our graduates are hired in highly competitive jobs in both the public and private sectors. Example placements of Ph.D. graduates from the APS program (Table 4) demonstrate the range of positions filled by our alumni. The demand for plant breeding jobs has remained relatively stable across all disciplines. Employers frequently request that graduates are competent in both classical and molecular breeding.

Graduate	Yr	Position
E. Pullins	2000	Res. Sci. USDA/APHIS
P. Seguin	2000	Asst. Prof. McGill Univ
P. Canci	2001	Cotton breeder, Delta Pine Co. (Brazil)
C. Handel	2001	Breeding consultant, McKinsey Consulting (Brazil)
A.M. Connor	2001	Res. Sci., Hort. & Food Res. Inst. (New Zealand)
R. Hayes	2002	Res. Plant Geneticist, USDA-ARS (CA)
J. Diaz	2002	Plant Sci., INIA (Uruguay)
N. Alsaady	2002	Prof., Sultan Qaboos Univ. (Oman)
J. Yu	2003	Postdoc., Cornell Univ.
M. Pacheco	2004	Asst. Prof., Federal Univ. Rio Grande do Sul (Brazil)
J. Biskiwa	2005	Prof., Makerere Univ. (Kampala, Uganda)
M. Arbelbide	2005	Res. Sci., Pioneer-Hi-Bred (MN)
I. Dinu	2005	Cotton breeder, Delta and Pine (MS)
N. Gomez	2005	Postdoc., NDSU
L. Litterer	2005	Support Sci., Promega (WI)
I. Makarevitch	2005	Postdoc., U of MN

Part V. Plant breeding course offerings

M.S. Degree Requirements. The M.S. degree is offered under Plans A (thesis) and B (special project). Plan A requires a minimum of 14 cr in the major field, 6 cr in a related or minor field, and 10 M.S. thesis cr. Plan B requires a minimum of 14 cr in the major field, 6 cr in a related or minor field, and 10 additional course cr. A common curriculum comprises courses in statistical analysis, plant biology, and orientation to Minnesota crop production; additional course requirements are flexible. M.S. students present one graduate seminar and must pass a final oral exam. Students usually complete the M.S. degree in two years.

Courses: APSc 8123 Ethics; Agro/Hort 5311 Orientation to MN Crop Production & Res. Meth.; Agro/Hort 8270 Seminar in Applied Plant Sciences; Stat 5021 Statistical Analysis; Genetics Area; Molecular Genetics Area; Plant Breeding Area. Additional courses in supporting program or minor field, Thesis credits 10 cr.

Ph.D. Degree Requirements. Ph.D. students need to complete a minimum of 30 cr in the major field, 12 cr in a related or minor field, and 24 Ph.D. thesis cr. In addition to the common curriculum required for M.S. students, Ph.D. students complete a supervised-teaching course, a current-topics course, and a thesis-proposal seminar. Additional course requirements are flexible. Ph.D. students need to pass a series of written preliminary exams followed by an oral preliminary exam. Ph.D. candidates need to pass a final oral exam based on the candidate's Ph.D. dissertation. Students usually complete the Ph.D. in 2-3 years.

Courses. APSc 8123 Ethics; Agro/Hort 5311 Orientation to MN Crop Production & Res. Meth.; Agro/Hort 8270 Seminar in APS; Stat 5021 Statistical Analysis; Agro/Hort/Soil 8005 Supervised Teaching Experience; Agro/Hort 8280 or SAgr 8010 Current Topics in APS, Colloquium in Sustainable Agriculture, Genetics Area, Molecular Genetics Area, Plant Breeding Area. Additional courses in Genetics, Molecular Genetics, Plant Breeding, and Statistics areas; Supporting program or minor field 12 cr; Thesis credits 24 cr.

Part VI. Institutional philosophy, strengths, weaknesses, future plans, etc.

The University of Minnesota aspires to be among the top three public research universities committed to the land grant mission. This implies basic to translational research (genomes to cultivars for APS students). Currently, genomes and cultivars are viewed as separate entities. Existing graduate programs in genomics, bioinformatics, and plant breeding create alumni in each area. Given that genomics and bioinformatics are two unifying disciplines, we believe they will also become driving forces in future plant improvement. Thus, there is a need for a cadre of scientists to translate genomics and bioinformatics into cultivar development. Our program educates Ph.D. students in the broad spectrum of genomics to applied plant breeding, providing (1) a solid background in plant genomics, (2) comprehension & use of genomics/bioinformatics tools, and (3) applying this knowledge in cultivar development.

