

# PLANT BREEDING

## PROGRAM INFORMATION

Program Director: E. Rios

Program Coordinator: E. Kampf

Plant Breeding is an interdisciplinary and interdepartmental graduate program that provides comprehensive training to prepare well-rounded and career-ready plant breeders for academic, industry, non-profit and other sectors. Our integrated curriculum equips students with traditional and contemporary breeding methodologies, including analysis of breeding trials, breeding methods and techniques, bioinformatics, gene editing, genomic prediction and quantitative genetics.

The Plant Breeding Graduate Program offers a Doctor of Philosophy degree that provides students with a strong background in experimental design and analysis during the first semester, and plant breeding theory and methods during the second semester. Our plant breeding faculty work with 50 plant species and represent diverse disciplines including: cell biology, genomics, molecular genetics, plant pathology, quantitative genetics & biometrics. For a complete faculty listing, please see the last page of this document.

To graduate in the program, students are required to have a minimum of 40 credits of coursework toward their major. Students must take all the 7 required courses listed below for a total of 20 credits of required courses and must additionally choose a minimum of 20 additional credits from the list of elective courses.

Minimum requirements for this degree are available in the Graduate Degrees (<http://gradcatalog.ufl.edu/content.php?catoid=12&navoid=2748>) section of this catalog. Successful applicants should have a B.S. or M.S. in agricultural, horticultural, forestry, biological or chemical sciences with desirable advanced undergraduate coursework in genetics, statistics, plant breeding, and biochemistry. However, outstanding students from a broad range of science and engineering disciplines will be considered.

All doctoral students must have at least one first author publication submitted to a peer-reviewed journal in their research field before graduation. Our students are strongly encouraged to publish before graduating.

Contact program director Dr. Esteban Rios at [estebanrios@ufl.edu](mailto:estebanrios@ufl.edu) or 352-301-2244

Contact program coordinator Eliana Kampf at [elianak@ufl.edu](mailto:elianak@ufl.edu) or 352-273-4760

For more information, please visit <https://programs.ifas.ufl.edu/plant-breeding/graduate-program/>

### Degrees Offered

## DEGREES OFFERED WITH A MAJOR IN PLANT Breeding

- Doctor of Philosophy

### Courses

## PLANT Breeding COURSES

The Plant Breeding Ph.D. degree will require a minimum of 90 post-baccalaureate credit hours and will include required courses, elective courses and dissertation research. To graduate in the program, students are required to have a minimum of 40 credits of coursework toward their major. All students are required to take 20 credits of required courses and must additionally choose a minimum of 20 additional credits from the list of elective courses.

**Students must take the following 20 credits of required courses toward the Plant Breeding major:**

### REQUIRED COURSES

Code	Title	Credits
AGR 5266C	Field Plot Techniques	3
AGR 5321C	Genetic Improvement of Plants	3
AGR 6325L	Plant Breeding Techniques	1
Students can take AGR 6325L any spring semester of odd years in coordination with their supervisory committee.		
HOS 6932	Special Topics	1-4
Students need to take a total of 7 credits of HOS 6932 Special Topics: HOS 6932 Survey of Breeding Tools and Methods (3 credits) and a minimum of 4 credits of HOS 6932 Journal Colloquium (1 credit) toward the major. HOS 6932 can be taken any fall and spring semester.		
PCB 6555	Introduction to Quantitative Genetics	3
Students can take PCB 6555 any fall semester of even years in coordination with their supervisory committee.		
STA 6093	Introduction to Applied Statistics for Agricultural and Life Sciences	3

**Students must choose a minimum of 20 credits from the list of electives below:**

### ELECTIVE COURSES

Code	Title	Credits
AGR 5307	Molecular Genetics for Crop Improvement	3
AGR 6305	Plant Chromosomes and Genomes	3
AGR 6322	Advanced Plant Breeding	3
AGR 5444	Ecophysiology of Crop Production	3
BCH 5045	Graduate Survey of Biochemistry	4
ENY 5006	Graduate Survey of Entomology	3
ENY 5006L	Graduate Survey of Entomology Laboratory	1
HOS 5242	Genetics & Breeding of Vegetable Crops	3
HOS 6201	Breeding Perennial Cultivars	3
HOS 6236	Molecular Marker Assisted Plant Breeding	3
HOS 6295	Methods in Plant Biotechnology	3
HOS 6932	Special Topics	1-4
HOS 6991	Fundamentals of Seed Biology	4
NEM 5004C	Graduate Survey of Nematology	3
PCB 5065	Advanced Genetics	4
PCB 5530	Plant Molecular Biology and Genomics	3
PCB 6685	Population Genetics	4
PLP 5005C	General Plant Pathology	4
PLP 6291	Plant Disease Diagnosis	3

Students admitted with an M.S. degree may be able to transfer up to 30 credits toward their elective courses requirement from a regionally accredited institution or international equivalent, subject to existing UF Graduate School policies.

The number of dissertation research credits will vary according to the student's field of study and progression toward research and degree.

### Agronomy Departmental Courses

Code	Title	Credits
AGR 5230C	Florida Grassland Agroecosystems	4
AGR 5266C	Field Plot Techniques	3
AGR 5277C	Tropical Crop Production	3
AGR 5307	Molecular Genetics for Crop Improvement	3
AGR 5321C	Genetic Improvement of Plants	3
AGR 5444	Ecophysiology of Crop Production	3
AGR 5511	Crop Ecology	3
AGR 6233	Tropical Grassland Agroecosystems	3
AGR 6237C	Research Techniques in Forage Evaluation	3
AGR 6305	Plant Chromosomes and Genomes	3
AGR 6322	Advanced Plant Breeding	3
AGR 6325L	Plant Breeding Techniques	1
AGR 6422C	Environmental Crop Nutrition	3
AGR 6442C	Physiology of Agronomic Plants	4
AGR 6905	Agronomic Problems	1-5
AGR 6913	Supervised Extension-Agronomy	3
AGR 6932	Topics in Agronomy	1-3
AGR 6933	Graduate Agronomy Seminar	1
AGR 6940	Supervised Teaching	1-5
AGR 6971	Research for Master's Thesis	1-15
AGR 7979	Advanced Research	1-12
AGR 7980	Research for Doctoral Dissertation	1-15
ALS 5155	Global Agroecosystems	3
ALS 5932	Special Topics	1-4
ALS 6031	Project Team Research: Building Skills in Agrobiology	3
IPM 5305	Principles of Pesticides	3
PLS 5625	Upland Invasive Plant Management	3
PLS 5632C	Integrated Weed Management	3
PLS 5633	Aquatic Plant Management	3
PLS 6626	Invasive Plant Ecology	3
PLS 6655	Plant/Herbicide Interaction	3

### Environmental Horticulture Departmental Courses

Code	Title	Credits
ALS 5934	Graduate Professional Development Seminar	2
BCH 5045	Graduate Survey of Biochemistry	4
HOS 5117C	Horticultural Plant Morphology and Identification	3
HOS 5432	Advanced Nutritional Management of Ornamental Crops	3
HOS 5515C	Greenhouse and Nursery Operations	3
HOS 5516C	Cultivation, Extraction, and Application of Medicinal Plants and Their Bioactive Compounds	3
HOS 6070	Plant Materials for Conservation and Restoration	3
HOS 6295	Methods in Plant Biotechnology	3
HOS 6523	Research and Development in Turfgrass Science	3
HOS 6905	Problems in Horticultural Science	1-4
HOS 6910	Supervised Research	1-5
HOS 6931	Horticultural Science Seminar	1
HOS 6932	Special Topics	1-4
HOS 6940	Supervised Teaching	1-5
HOS 6941	Practicum in Horticultural Science	2-4
HOS 6971	Research for Master's Thesis	1-15

HOS 6991	Fundamentals of Seed Biology	4
HOS 7979	Advanced Research	1-12
HOS 7980	Research for Doctoral Dissertation	1-15
ORH 5026C	Advanced Annual and Perennial Gardening	3
ORH 5086	Advanced Golf and Sports Turf Management	2
ORH 5282	Orchid Biology and Culture	3
ORH 5817C	Advanced Florida Native Landscaping	3
PLS 5222C	Propagation of Horticultural Crops	3
PLS 5241C	Advanced Plant Micropropagation	4

### Horticultural Sciences Departmental Courses

Code	Title	Credits
ALS 5932	Special Topics	1-4
HOS 5085C	Principles of Postharvest Horticulture	3
HOS 5242	Genetics & Breeding of Vegetable Crops	3
HOS 5330	Postharvest Technologies for Horticultural Crops	2
HOS 5505	Getting Published Horticulture	3
HOS 5555	Tropical Fruit Production and Research in Florida	3
HOS 5711	Phytochemicals in Food & Health	3
HOS 6201	Breeding Perennial Cultivars	3
HOS 6236	Molecular Marker Assisted Plant Breeding	3
HOS 6307	Horticultural Physiology	3
HOS 6331	Postharvest Biology	3
HOS 6345	Environmental Physiology	4
HOS 6355	Root and Rhizosphere Ecology	3
HOS 6412	Nutrition of Horticultural Crops	3
HOS 6545	Advanced Citriculture I	3
HOS 6905	Problems in Horticultural Science	1-4
HOS 6910	Supervised Research	1-5
HOS 6931	Horticultural Science Seminar	1
HOS 6932	Special Topics	1-4
HOS 6934	Professional Seminar Preparation	1
HOS 6940	Supervised Teaching	1-5
HOS 6941	Practicum in Horticultural Science	2-4
HOS 6971	Research for Master's Thesis	1-15
HOS 7979	Advanced Research	1-12
HOS 7980	Research for Doctoral Dissertation	1-15
PCB 5065	Advanced Genetics	4
PCB 5530	Plant Molecular Biology and Genomics	3
PCB 6528	Plant Cell and Developmental Biology	3
PCB 6910	Supervised Research	1-5
PCB 6937	Special Topics in Plant Molecular and Cellular Biology	1-4
PCB 6971	Research for Master's Thesis	1-15
PCB 7922	Journal Colloquy in Plant Molecular and Cellular Biology	1
PCB 7979	Advanced Research	1-12
PCB 7980	Research for Doctoral Dissertation	1-15
PLS 6635	Weed Management for Organic and Sustainable Cropping Systems	3
PLS 7979	Advanced Research	1-12
PLS 7980	Research for Doctoral Dissertation	1-15

### School of Forest, Fisheries, and Geomatics Sciences Departmental Courses

Code	Title	Credits
FAS 5015	Aquaculture I	3
FAS 5203	Biology of Fishes	3
FAS 5203C	Biology of Fishes	4

FAS 5255	Diseases of Warmwater Fish	3
FAS 5276C	Field Ecology of Aquatic Organisms	4
FAS 5335C	Applied Fisheries Statistics	4
FAS 5407	Biology of Fishery and Aquaculture Invertebrates	3
FAS 5901	Scientific Thinking in Ecology	2
FAS 6154	Marine Adaptations: Environmental Physiology	3
FAS 6165	Fish and Crustacean Nutrition	3
FAS 6176	Algae Biology and Ecology	3
FAS 6238	Environmental Physiology of Fishes	3
FAS 6256	Fish and Aquatic Invertebrate Histology	3
FAS 6272	Marine Ecological Processes	3
FAS 6273	Trophic Ecology of Fishes	3
FAS 6275	Freshwater Ecology	3
FAS 6306C	Spatial Sciences for Marine Environmental Characterization	4
FAS 6337C	Fish Population Dynamics	4
FAS 6339C	Advanced Quantitative Fisheries Assessment	4
FAS 6355C	Fisheries Management	4
FAS 6356	Fisheries Enhancement	2
FAS 6356	Fisheries Enhancement	2
FAS 6357	Marine Protected Areas	3
FAS 6360	Invasion Ecology of Aquatic Animals	3
FAS 6408	Aquaculture II	3
FAS 6416	Spatial Ecology and Modeling of Fish Populations	2
FAS 6705	Fisheries and aquaculture: An economics perspective	3
FAS 6905	Individual Study	1-6
FAS 6910	Supervised Research	1-5
FAS 6932	Special Topics in Fisheries and Aquatic Sciences	1-4
FAS 6933	Graduate Symposium	1
FAS 6935	Contemporary Problems in Fisheries and Aquatic Sciences	2
FAS 6940	Supervised Teaching	1-5
FAS 6971	Research for Master's Thesis	1-15
FAS 7979	Advanced Research	1-12
FAS 7980	Research for Doctoral Dissertation	1-15
FNR 5072C	Environmental Education Program Development	3
FNR 5608	Research Planning	3
FNR 5625	Managing Public Lands and Waters	3
FNR 6061	Conflict and Collaboration in Natural Resources	3
FNR 6560	Intro to Bayesian Statistics for Life Sciences	3
FNR 6564	Ecohydrology	3
FNR 6628	Watershed Management and Restoration	3
FNR 6668	Natural Resources in a Changing Climate	3
FNR 6669	Policy and Economics of Natural Resources	3
FOR 5157	Ecosystem Restoration Principles and Practice	3
FOR 5159	Ecology and Restoration of Longleaf Pine Ecosystems	3
FOR 5435	Forest Information Systems	3
FOR 5626	Forest Resource Manag	3
FOR 6005	Conservation Behavior	3
FOR 6045	Science Communication & Public Education	3
FOR 6151	Forest Ecosystem Health	3
FOR 6154	Analysis of Forest Ecosystems	3
FOR 6155	Forest Ecosystem Resilience	3
FOR 6156	Simulation Analysis of Forest Ecosystems	3
FOR 6158	Management and Restoration of Invaded Ecosystems	3
FOR 6164	Silviculture: Concepts and Application	3
FOR 6170	Tropical Forestry	3
FOR 6215	Fire Paradigms	3
FOR 6340	Physiology of Forest Trees	3
FOR 6436C	Visualization of Ecological Data	3
FOR 6543	Natural Resource Economics and Valuation	3
FOR 6625	Issues in Southeastern Forest Health	3
FOR 6628	Community Forest Management	3
FOR 6665	Landscape Planning for Ecotourism	3
FOR 6670C	Urban Forestry	3
FOR 6905	Research Problems in Forest Resources and Conservation	1-6
FOR 6910	Supervised Research	1-5
FOR 6933	Seminar	1
FOR 6934	Topics in Forest Resources and Conservation	1-4
FOR 6940	Supervised Teaching	1-5
FOR 6971	Research for Master's Thesis	1-15
FOR 7979	Advanced Research	1-12
FOR 7980	Research for Doctoral Dissertation	1-15
GIS 6103	GIS Programming and Customization	3
GIS 6116	Geographic Information Systems Analysis	3
GIS 6116	Geographic Information Systems Analysis	3
PCB 5530	Plant Molecular Biology and Genomics	3
PCB 6528	Plant Cell and Developmental Biology	3
PCB 6555	Introduction to Quantitative Genetics	3
SUR 5365	Digital Mapping	3
SUR 5385	Remote Sensing Applications	3
SUR 5386	Image Processing for Remote Sensing	3
SUR 5525	Least Squares Adjustment Computations	3
SUR 6346	Marine Geomatics	3
SUR 6355	Analytical Photogrammetry	3
SUR 6377	Geospatial Application of UASs	3
SUR 6395	Topics in Geographic Information Systems	3
SUR 6502C	Foundations of UAS Mapping	3
SUR 6535	GPS-INS Integration	3
SUR 6536	Geodesy and Geodetic Positioning	3
SUR 6905	Special Problems in Geomatics	1-6
SUR 6934	Topics in Geomatics	1-4
SUR 6940C	Practicum in UAS Mapping	3

## Research Credits

Code	Title	Credits
PLS 7979	Advanced Research	1-12
PLS 7980	Research for Doctoral Dissertation	1-15

## Student Learning Outcomes

### Plant Breeding (PHD)

Knowledge:

SLO 1: Students explain and apply fundamental theory and principles of plant breeding, such as genetics and genomics, plant biochemistry, plant transformation technologies, and computational genetics.

SLO 2: Students apply genetic inheritance theory to crops of interest and develop a research proposal and a dissertation for a targeted crop/trait/method based on the biology of the crop and

the technology available.

Skills:

SLO 3: Students use critical thinking to revise scientific literature and to evaluate, plan, analyze, and design experiments related to plant breeding and cultivar development.

SLO 4: Students prepare and complete plant breeding research of sufficient quality to be published in peer-reviewed journals.

SLO 5: Students communicate plant breeding knowledge effectively and clearly in oral form to peers, scientists, industry, producers, and the general public.

Professional Behavior:

SLO 6: Students interact with peers, faculty, and staff with honesty, respect, ethical behavior, cultural sensitivity, fellowship, and cooperation