AGR 6322 Advanced Plant Breeding

Graduate Level – 3 credit hours

Fall 2018

Instructors: Dr. Esteban Rios
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Dr. Matias Kirst (Population Genetics module)
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Teaching Assistant: Dr. Luis Felipe Ferrao
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Location and time: Tuesday period 8 (3:00-3:50), FIF 2316
Thursday periods 8 and 9 (3:00-4:55), FIF 2316

Pre-requisites

AGR5321 – Genetic Improvement of Plants or equivalent plant breeding course
STA616 or equivalent.

Course Description

This course focuses on practical application of plant breeding, genetics, and statistics to devise effective approaches to meet particular breeding goals. Highlighting real life situations and key decisions that plant breeders face, the course builds upon knowledge of plant breeding methods and quantitative genetic theory. Four specific functional areas, which somewhat reflect divisions of labor in breeding programs and seed industry, are addressed: population development, population evaluation, trait integration, and product commercialization and supply.

Intended Audience

The course is designed for MS and PhD graduate students in the following disciplines: plant breeding, agronomy, horticultural sciences, plant genetics and molecular genetics.

Course Objectives

To familiarize students with advanced breeding strategies, methods, and techniques in plant breeding, and how to apply those concepts in breeding programs. At the end of the course, students should be able to describe and discuss population genetic parameters, mating designs, differentiate between mating designs for additive and dominance variation, and genomic selection.

Evaluation

Activity	Number	Points/Activity	Total
Quizzes	4	2.5	10
Paper Discussion	1	20	20
Breeding Proposal – Written	1	20	20
Breeding Proposal – Oral	1	20	20
Final Take-home Exam	1	30	30

A >90 B+ 85 to 89 B 80 to 84 C+ 75 to 79 C 70 to 74 D+ 65 to 69 D 60 to 64 E < 60

UF grading policies: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

Quizzes
Quizzes will happen randomly during class. They will consist of a question pertinent to the topic being discuss that day. Students are required to answer the question in a piece of paper. Student must write their complete name and UFID number in the paper. There will be no notice of when quizzes are happening and THERE IS NO MAKE UP OF QUIZZES.

Paper Discussions
A peer-reviewed scientific paper will be assigned one week in advance to each student randomly. Students will lead the discussion for that paper and present questions to the class to encourage participation. Each student will receive a grade after based on their paper discussion and class participation. No discussion grades make-up.

Breeding Proposal
A Request For Proposals (RFP) will be presented to students at the beginning of the semester. Students will work individually to write and present orally their proposed work and budget. Students will get training on proposal writing, budget preparation and proposal submission by the UF-IFAS Shared Services during class hours. The written proposal will have to follow the RFP's guidelines and the oral presentation will be limited to 10 minutes per student.

Exam
There will be a final take-home exam on December 4 and it will be due in 24 hours after handing out. If you are unable to take an exam the instructor must be notified prior to the exam by phone or email if you wish to make up the exam. Without notification a zero will be recorded.

Software and computer
You will need to bring your own laptop when requested. Different software will be used during the semester. Specific instruction where to obtain them will be given in class.

Recommended Literature – specific scientific papers will be assigned as the semester progresses

D.L. Hartle & A.G. Clark – *Principles of Population Genetics*, Fourth Edition. 2006.
D.S. Falconer – *Introduction to Quantitative Genetics,* 2nd edition. 1981.
M.L. Lynch & B. Walsh – Genetics and Analysis of Quantitative Traits. 1998
Mrode, R. A. Linear Models for the Prediction of Animal Breeding Values. Boston, MA :CABI, 2014. Print.

Course Schedule and Topics (Tentative)

Week	Description
	Area: Population development
1	Theme: Basic Concepts in Plant Breeding Day 1: Thursday Aug 23 a. Basic Concepts in Plant Breeding (Dr. Rios)
2	Theme: Population Genetics I Day 1: Tuesday Aug 28 a. Population Genetics I (Dr. Kirst) Day 2: Thursday Aug 30 a. Population Genetics II (Dr. Kirst) b. Demo on R and Population Genetics (Dr. Ferrao)

3	Theme: Population Genetics I (Dr. Kirst and Dr. Ferrao) Day 1: Tuesday Sept 4 a. Population Genetics III (Dr. Kirst) Day 2: Thursday Sept 6 a. Paper discussion on Population Genetics – Leaders: TBD b. IFAS Shared Services: writing proposals, budget preparation, and proposal submission.
4	Theme: Mating Designs Day 1: Tuesday Sept 11 a. Mating Designs I (Dr. Rios) Day 2: Thursday Sept 13 a. Mating Designs II (Dr. Rios) b. Paper discussion on Mating Designs – Leaders: TBD
5	Theme: Polyploidy and Quantitative Genetics Day 1: Tuesday Sept 18 a. Polyploidy in Breeding (Dr. Rios) Day 2: Thursday Sept 20 a. Paper discussion on Polyploidy in Breeding – Leaders: TBD b. Quantitative Genetics Review (Dr. Rios)
	Area: Population Evaluation
6	Theme: Experimental Designs Use in Plant Breeding Day 1: Tuesday Sept 25 a. Experimental Designs Use in Plant Breeding I (Dr. Rios) Day 2: Thursday Sept 27 a. Experimental Designs Use in Plant Breeding II (Dr. Rios) b. Paper discussion on Experimental Designs – Leaders: TBD
7	Theme: Use of BLUP in breeding - Use of Pedigree Information in Breeding Day 1: Tuesday Oct 2 a. Use of BLUP in breeding (Dr. Rios) Day 2: Thursday Oct 4 a. Use of BLUP/Pedigree Information in Breeding (Dr. Rios) b. Demo on Use of BLUP/Pedigree Information in Breeding (Dr. Ferrao)
8	Theme: Genotype by Environment and Multi-Site Analysis - High-Throughput Phenotyping Day 1: Tuesday Oct 9 a. Genotype by Environment and Multi-Site Analysis (Dr. Rios) Day 2: Thursday Oct 11 a. High-Throughput Phenotyping (Invited Speakers)
	Area: Trait Integration
9	Theme: Use of molecular tools in Plant Breeding Day 1: Tuesday Oct 16 a. QTL mapping and Marker Assisted Selection (Dr. Rios) Day 2: Thursday Oct 18 a. Applying Marker Assisted Selection in a Breeding Program (Invited Speaker) b. Paper discussion on QTL mapping and Marker Assisted Selection – Leaders: TBD

10	Theme: Genomic Breeding Day 1: Tuesday Oct 23 a. Genomic Breeding I: Genome-wide Association Studies (Dr. Ferrao) Day 2: Thursday Oct 25 a. Paper discussion on Genome-wide Association Studies– Leader: TBD b. Special Seminar: *From Breeding to Molecular Breeding: A 40 Year Perspective* (Dr. Joseph Bouton, Professor Emeritus, UGA).
11	Theme: Genomic Breeding Day 1: Tuesday Oct 30 a. Genomic Breeding II: Genomic Prediction (Dr. Rios) Day 2: Thursday Oct 31 a. Applying Genomic Prediction in a Breeding Program (Invited Speaker) b. Paper discussion on Genomic Prediction – Leader: TBD
12	**NO CLASS Nov 6 and 8. CROP SCIENCE MEETING in Baltimore, MD**
13	Theme: Genomic Breeding Day 1: Tuesday Nov 13 a. Applying Genome Editing in a Breeding Program (Invited Speaker)
	Area: Product Commercialization, Marketing and Supply
13	Theme: Intellectual Property Protection in Plant Breeding Day 2: Thursday Nov 15 a. IP in Plant Breeding: Cultivar Release and Marketing (Invited Speaker)
14	Theme: New methods in Breeding Day 1: Tuesday Nov 20 a. Paper discussion on Genome Editing – Leader: TBD **Day 2: Thursday Nov 22 No Class – Thanksgiving**
15	Theme: Proposal Presentations Day 1: Tuesday Nov 27 a. Proposal Presentations: 6 students Day 2: Thursday Nov 30 a. Proposal Presentations: 10 students
16	Theme: Final Exam Day 1: Tuesday Dec 4 a. Take-home Exam (TBD)

ADDITIONAL REFERENCES

- Bernardo, R. 2010. Breeding for Quantitative Traits in Plants. Second Edition. Stemma Press, Minnesota.
- Cameron, N.D. 1997. Selection Indices and Prediction of Genetic Merit in Animal Breeding. CAB International. Wallington, UK.
- Hallauer, A.R.; Carena, M.J. Miranda Filho, J.B. 2010. Quantitative Genetics in Maize Breeding. Springer, New York.
- Henderson, C.R. 1984. Applications of Linear Models in Animal Breeding. University of Guelph.
- Kearsey, M. J. and H. S. Pooni. 1996. The Genetical Analysis of Quantitative Traits. Chapman & Hall, New York.
- Littell, R. C.; Milliken, G.A.; Strop, W.W.; Wolfinger, R.D. and O. Schabenberger. 2006. SAS for Mixed Models. Second Edition. Cary, NC: SAS Institute Inc.

- Mather, K. and J. L. Jinks. 1977. Introduction to Biometrical Genetics. Cornell University Press, Ithaca, New York.

Attendance and Make-Up Work
"Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx."

Online Course Evaluation Process
"Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/."

Academic Honesty
"UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (http://www.dso.ufl.edu/sccr/process/student-conduct-honorcode/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class."

Software Use:
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

Services for Students with Disabilities
"Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester."

Campus Helping Resources
Health and Wellness:

U Matter, We Care: If you or a friend is in distress, please contact umatter@ufl.edu or 352 392- 1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc/Default.aspx, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS) Student Health Care Center, 392-1161. University Police Department, 392-1111 (or 9-1-1 for emergencies). http://www.police.ufl.edu/