

## Plant Breeding

11:776:406 (4 credits)

[Cross-listed: 17:765:529 Plant Breeding (graduate level)]  
Spring Semester (yearly)

### CONTACT INFORMATION

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Office Hours: by e-mail appointment

### COURSE DESCRIPTION

History, theory, and practice of plant breeding.

### COURSE WEBSITE, RESOURCES AND MATERIALS

- Course website: Sakai
- Required textbook:
  - Breeding Field Crops 5th Ed.
  - David Allen Sleper and John Milton Poehlman
  - Iowa State University Press – Ames, IA
  - Copyright: 2006
  - ISBN 10: 0-8138-2428-1
- Other references used:
  - Principles of Cultivar Development Vol. 1 – Theory and Technique  
Walter R. Fehr  
Macmillan Publishing Company, NY  
Copyright: 1987  
ISBN: 0-02-949920-8
  - Principles of Plant Breeding  
Robert Allard  
John Wiley & Sons, Inc., NY

Copyright: 1960

ISBN: 0-471-02310-8

- Principles of Genetics  
Peter Snustad, Micheal Simmons, John Jenkins  
John Wiley & Sons, Inc., NY.  
Copyright: 1997  
ISBN: 0-471-31196-0

## PREREQUISITE

01:119:115 General Biology OR 01:119:103 Principles of Biology OR 11:776:242 Plant Science

## COURSE LEARNING GOALS

(Link to Plant Biology Undergraduate Program Goals: <http://plantbiology.rutgers.edu/undergrad/plantbiology/>)

By the end of this course, the student will be able to:

1. Describe the foundation (concepts, terminology and tools) of plant breeding (addresses program goals 1 and 2)
2. Explain and demonstrate the use various breeding techniques to improve plant traits (addresses program goals 1, 3, and 4)
3. Describe procedures for current commercial application in plant breeding (addresses program goals 3 and 4)

## ASSIGNMENTS/RESPONSIBILITIES AND ASSESSMENT

### Grading:

- Exam I: 20%
- Final Exam: 25%
- Homework: 10%
- Breeding project: 20%
- Laboratory participation and assignments (five) 25%
- Crosses – more than five, extra credit
- Scale: 90-100% = A; 80-89 = B; 70-79 = C; 60-69 = D

**Breeding project assignment:** Students will write a 6 to 9 page paper (with references) on a specific breeding objective within a particular crop of interest. Papers include a literature review (citation of peer review publications required), characteristics of the train, and breeding scheme and methods.

**Learning goals assessment:** Specific questions on exams and specific homework assignments will be used to assess student knowledge of all course learning goals. Sections of the breeding project assignment will be used to address course learning goals 2 and 3. Plant breeding crosses will be used to assess course learning goal 2. The percentage score on these assessments will determine the level of mastery: >90% outstanding; 80-89% good; 70-70% satisfactory; <69% unsatisfactory.

## ABSENCE POLICY

Students unable to attend may contact the instructor via e-mail prior to the missed class or may use the University absence reporting website (<https://sims.rutgers.edu/ssra/>) to indicate the date and reason for the absence. An e-mail is automatically sent to the instructor.

## COURSE SCHEDULE

### Lecture Schedule

| Lecture  | Topic  | Book Chapter |
|--|--|--------------|
| <b>Foundation – Concepts, Terminology, and Tools</b>   |  |              |
| 1  | History, plant domestication, important plant breeders           | 1            |
| 2  | Germplasm preservation, Vavilov, collection, testing             | 1, 2, 7      |
| 3  | Modes of reproduction (asexual, sexual – meiosis), reprod. sys.  | 2, 7         |
| 4  | Reproductive systems (cont.) (apomixis)                          | 2, handout   |
| 5  | Genetic variation and recombination – review genetics            | 3            |
| 6  | Qualitative vs. quantitative genetics – statistics, heritability | 4, handout   |
| 7  | Quantitative genetics (cont.) /H–W equil.                        | 9, 10        |
| 8  | Effect of long term selection                                    | handout      |
| 9  | Cytogenetics, polyploidy – variation in chromosome number        | 5            |
| 10   | Mutation, somaclonal variation                                   | 13           |
| 11   | Biotechnology, molecular markers in plant breeding               | 6, 8         |
| 12   | Genomics in plant breeding I                                     | 8            |
| 13   | Genomics in plant breeding II                                    | 8            |
| 14   | <b>Exam I</b>  |              |
| <b>Breeding Methods</b>                                |  |              |
| 15   | Self-pollinated crops – IB lines, pedigree, ssd, backcross       | 9            |
|  | <b>Spring recess</b>   |              |
| 16   | Self-pollinated crops (cont.)                                    | 9, 10        |
| 17   | Cross-pollinated crops – inbreed. dep., heterosis, recur. selec. | 10           |
| 18   | Breeding for pest resistance – diseases, insects, nematodes      | 12, handout  |
| 19   | Breeding for pest resistance case studies                        |              |
| 20   | Breeding for pest resistance case studies (cont.)                |              |
| 21   | Breeding asexually propagated cultivars                          | 10           |
| 22   | Breeding hybrid cultivars  | 11           |
| <b>Commercialization and Breeding Program Examples</b> |  |              |
| 23   | Plant breeder's rights   |              |
| 24   | Variety testing and seed increase                                |              |
| 25   | <b>Breeding projects due</b>                                     | 12           |
|  | Breeding systems examples (vegetable crops)                      |              |
| 26   | Breeding cranberries/blueberries                                 |              |
| 27   | Breeding turfgrasses and biofuels                                | 12, 20       |
| 28   | Breeding basil   |              |
| <b>Final Exam (date to be determined)</b>              |  |              |

## Laboratory Schedule

| Week                 | Topic   | Location                    | Assignment  |
|----------------------|---|-----------------------------|---|
| 1                    | No class  |                             |   |
| 2                    | Tomato crosses<br>Watch Seed Hunter video                                 | FG 115                      | Assignment 1 – Seed Hunter                                      |
| 3                    | Tomato crosses (cont.)  | FG 115                      | Assignment 2 – Tomato crossing<br><b>Assignment 1 due</b>       |
| 4                    | Pepper/tomato crosses (cont.)   | FG 115                      |   |
| 5                    | Hazelnut kernel evaluation  | FG 115                      | Assignment 3 – Kernel evaluation                                |
| 6                    | Field trip – hazelnut breeding program                                    | Greenhouse,<br>Hort. Farm 3 |   |
| 7                    | Basil Breeding  | FG 115                      |   |
| 8                    | Tomato fruit size experiment  | Hort. Farm 3                | Assignment 4 – Tomato fruit size<br><b>Assignment 3 due</b>     |
| <b>Spring recess</b> |   |                             |   |
| 9                    | DNA markers/JoinMap   | FG 115                      | Assignment 5 – DNA<br>marker/JoinMap<br><b>Assignment 4 due</b> |
| 10                   | Eastern filbert blight disease screening                                  | FG 115                      | Assignment 6 – Disease screening                                |
| 11                   | Tomato cross fruit harvest and seed extraction; hybrid<br>crosses (cont.) | FG 115                      | <b>Assignment 5 due</b>   |
| 12                   | Apple and peach breeding program  | FG 115                      | <b>Assignment 6 due</b>   |
| 13                   | Dogwood breeding lab  | FG 115                      |   |
| 14                   | Field trip – turfgrass breeding program                                   | Adelphia                    | <b>Assignment 2 due</b>   |

## FINAL EXAM/PAPER DATE AND TIME

The Online Final exam Schedule: <http://finalexams.rutgers.edu/>

## ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

Please follow the procedures outlined at <https://ods.rutgers.edu/students/registration-form>. Full policies and procedures are at <https://ods.rutgers.edu/>

## ACADEMIC INTEGRITY

The university's policy on Academic Integrity is available at <http://academicintegrity.rutgers.edu>

The principles of academic integrity require that a student:

- Properly acknowledge and cite all use of the ideas, results, or words of others.
- Properly acknowledge all contributors to a given piece of work.
- Make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- Obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.

- Treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- Uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that:

- Everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
- All student work is fairly evaluated and no student has an inappropriate advantage over others.
- The academic and ethical development of all students is fostered.
- The reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

## STUDENT WELLNESS SERVICES

**Just In Case Web App** <http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

### **Counseling, ADAP & Psychiatric Services (CAPS)**

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901 / [www.rhscaps.rutgers.edu/](http://www.rhscaps.rutgers.edu/)

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

### **Violence Prevention & Victim Assistance (VPVA)**

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / [www.vpva.rutgers.edu/](http://www.vpva.rutgers.edu/)

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

### **Disability Services**

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in

your courses as possible. To begin this process, please complete the Registration form on the ODS web site at:  
<https://ods.rutgers.edu/students/registration-form>.

**Scarlet Listeners**

(732) 247-5555 / <http://www.scarletlisteners.com/>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.