

UNIVERSITY OF FLORIDA
Horticultural Sciences Department

Genetics & Breeding of Vegetable Crops
HOS 5242, Section 04EE
Spring 2018

Instructors:

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Office hours: By appointment.

Prerequisites: AGR 3303 or equivalent

Credit hours: 3

Frequency: Offered Spring semester

Meeting Days and Times:

Tue, 1:55 to 2:45 p.m. (period 7) and Thu 1:55 to 2:45 and 3:00 to 3:50 (periods 7 and 8).

Location: Room 5, PSF

Course format: Lectures, discussion, student research and student presentations

Course Description: Traditional and molecular breeding methods for vegetable crops and the influence of scientific research, government policies, industry needs and consumer preferences on vegetable crop improvement.

Learning Objectives:

At the conclusion of this course, the student will be able to:

- Apply traditional and molecular breeding methods for the enhancement of vegetable crops.
- Interpret how plant breeding, scientific research, genetic diversity, germplasm resources and conservation, government policies, industry needs and consumer preferences can affect vegetable crop improvement programs.
- Design and present a vegetable breeding research project that meets specific short-term and long-term goals.

Textbooks: There is no required textbook for this course. **Optional textbooks** are listed below:

“An Introduction to Plant Breeding” by Jack Brown and Peter Caligari, Blackwell Publishing, 2008. ISBN 978-1-4051-3344-9.

“Molecular Plant Breeding” by Yunbi Xu, CABI publishing, Oxfordshire, England, 2010. ISBN 13:978-1-84593-982-3 (PB).

“Breed your own vegetable varieties: The Gardener’s and farmer’s guide to plant breeding and seed saving” by Carol Deppe, 2nd Edition. Green Books Ltd., Totnes. ISBN 1-890132-72-1.

Assigned Reading List:

Asins, M.J. (2002) Present and future of quantitative trait locus analysis in plant breeding. *Plant Breeding*, 121:281-291.

Bai Y, Lindhout P. (2007) Domestication and breeding of tomatoes: What we have gained and what can we gain in the future? *Ann Bot* 100: 1085-1094.

Kihara, H. (1951) Triploid watermelons. *Proc of the American Soc Hort Sci*. 58: 217-230.

Olsson G. (1960) Species crosses within the genus *Brassica*. 2. Artificial *Brassica napus* L. *Hereditas* 46: 351-386.

Liu et al (2014) The *Brassica oleracea* genome reveals the asymmetrical evolution of polyploidy genomes. *Nature Communications* 5: Article number 3930.

Gray AR, Crisp P. (1977). Breeding system, taxonomy, and breeding strategy in cauliflower, *Brassica oleracea* var. *botrytis* L. *Euphytica* 26: 369-375.

Hale AL, Farnham MW, Nzaramba M, Kimbeng CA. (2007) Heterosis for horticultural traits in Broccoli. *Theor Appl Gen* 115: 351-360.

Farinho, P. Coelho, J. Carlier, D. Svetleva, A. Monteiro and J. Leitao. (2004) Mapping a locus for adult plant resistance to downy mildew in broccoli (*Brassica oleracea* convar. *italica*). *Theor. Appl. Genet.* 109:1392-1398.

Martin, G.B., Brommonschenkel, S.H., Chunwongse, J., Frary, A., Ganai, M.W., Spivey, R., Earle, E.D., Tanksley, S.D. (1993) Map-based cloning of a protein-kinase gene conferring disease resistance in tomato. *Science* 262: 1432-1436.

Tricoli DM, Carney KJ, Russell PF, McMaster JR., Groff DW, Hadden KC, Himmel PT, Hubbard JP, Boeshore ML, Quemada HD. (1995) Field evaluation of transgenic squash containing single or multiple virus coat protein gene constructs for resistance to cucumber mosaic-virus. *Bio-Technology* 13: 1458-1465.

Gaskell, G., N. Allum, M. Bauer and W. Wagner. (2008) Biotechnology and the European Public. *Nature Biotechnology*, 18:935-938. <http://biotech.nature.com>.

Holland, J.B. (2004) Implementation of molecular markers for quantitative traits in breeding programs - challenges and opportunities. *Proceedings of the 4th International Crop Science Congress*, 1-13. www.cropscience.org.au.

Jeuken, M.J.W and P. Lindhout. (2004) The development of lettuce backcross inbred lines (BILs) for exploitation of the *Lactuca saligna* (wild lettuce) germplasm. *Theor. Appl. Genet.* 109:394-401.

Mohan, M., S. Nair, A. Bhagwat, T.G. Kirshna, M. Yano, C.R. Bhatia and T. Sasaki. (1997) Genome mapping, molecular markers and marker-assisted selection in crop plants. *Molecular Breeding*. 3:87-103.

Rao, G.U., A.B. Chaim, Y. Borovsky and I. Paran. (2003) Mapping of yield-related QTLs in pepper in an interspecific cross of *Capsicum annuum* and *C. frutescens*. *Theor. Appl. Genet.* 106:1457-1466.

Vilarinho, L.B.O., Silva, D.J.H., Greene, A., Salazar, K.D., Alves, C., Eveleth, M., Nichols, B., Tehseen, S., Khoury Jr., J.K., Johnson, J.V., Sargent, S.A., Rathinasabapathi, B. (2015) Inheritance of fruit traits in *Capsicum annuum*: Heirloom cultivars as sources of quality parameters relating to pericarp shape, color, thickness and total soluble solids. *Journal of the American Society for Horticultural Science* 140: 597-604.

Sakata, Y., N. Kubo, M. Morishita, E. Kitadani, M. Sugiyama and M. Hirai. (2006) QTL analysis of powdery mildew resistance in cucumber (*Cucumis sativus* L.). *Theor. Appl. Genet.* 112:243-250.

Elshire RJ, Glaubitz JC, Sun Q, Poland JA, Kawamoto K, Buckler ES, Mitchell SE. (2011) A robust, simple genotyping-by-sequencing (GBS) approach for high diversity species. PLoS ONE 6: e19379.

Shi, M.M. (2001) Enabling large-scale pharmacogenetic studies by high-throughput mutation detection and genotyping technologies. Clinical Chemistry 47:164-172.

Tiwari, K.R., G.A. Penner and T.D. Warkentin. Identification of coupling and repulsion phase RAPD markers for powdery mildew resistance gene er-1 in pea. Genome, 41:440-444.

Zhang, R, X. Yong, K. Yi, H. Zhang, L. Liu and G. Gong. (2004). A genetic linkage map for watermelon derived from recombinant inbred lines. J. Amer. Soc. Hort. Sci. 129:237-243.

Rommens, C.M. (2004) All-native DNA transformation: a new approach to plant genetic engineering. Trends in Plant Science, 9:1360-1385.

Hall BG (2013) Building phylogenetic trees from molecular data with MEGA. Mol. Biol. Evol. 30: 1229-1235.

Additional or alternative readings may be selected from current literature and will be made available to the students in the form of a photocopy or an electronic file.

Tentative List of Topics:

Date	Topics	Instructor(s)
1/9/2018, Tue	Introduction, Review of syllabus and discussion topics	BR, KF, JS
1/11/2018, Thu	Activity 1. Introduction to pepper breeding program	BR
1/16/2018, Tue	The domestication of plants and genetic diversity in vegetable crops	KF
1/18/2018, Thu	Qualitative traits and review of Mendelian genetics	BR
1/23/2018, Tue	Modes of reproduction in vegetable crops	BR
1/25/2018, Thu	Activity 2. Making a genetic cross	BR
1/30/2018, Tue	Breeding schemes & Induced mutagenesis	BR
2/1/2018, Thu	Activity 3. Planting a mapping population	BR
2/6/2018, Tue	Basics of Quantitative genetics	BR
2/8/2018, Thu	Activity 4. Nuclear DNA isolation and marker technologies	JS, BR
2/13/2018, Tue	Heritability	JS
2/15/2018, Thu	Activity 5. Analysis of quantitative data	JS
2/20/2018, Tue	QTL mapping	JS
2/22/2018, Thu	Activity 6. Linkage analysis	JS
2/27/2018, Tue	Heterosis and sweet corn breeding	JS
3/1/2018, Thu	Genome wide association mapping	JS

3/6/2018	No class - Spring break	
3/8/2018	No class - Spring break	
3/13/2018, Tue	Genetic transformation	KF
3/15/2018, Thu	Activity 7. Bioinformatics related to QTL mapping	BR, JS
3/20/2018, Tue	Genome editing	KF
3/22/2018, Thu	Activity 8. Anther culture	BR
3/27/2018, Tue	New breeding objective and tools for vegetable breeding	KF
3/29/2018, Thu	Activity 9. Student projects - independent research and preparation	BR
4/3/2018, Tue	Student presentation of their projects	BR, JS
4/5/2018, Thu	Student presentation of their projects	BR, JS
4/10/2018, Tue	Student presentation of their projects	BR, JS
4/12/2018, Thu	Student presentation of their projects	BR, JS
4/17/2018, Tue	Student presentation of their projects	BR, JS
4/19/2018, Thu	Activity 10. Greenhouse clean up and seed extraction	BR
4/24/2018, Tue	Student presentation of their projects	BR

*Instructors: BR- Bala Rathinasabapathi, JS-Jugpreet Singh and KF – Kevin Folta

Class Assignment:

- (a) Each student will do the lab exercises set for each week related to vegetable breeding, keep a journal of notes about what has been done and write reports for grade. Even if some of the exercises may be done in groups, each student should write the notebook and reports individually.
- (b) Students will develop a research project in vegetable breeding in consultation with the instructors. Opportunities for the choice of the projects will be discussed in class.

Written Report: Lab reports are expected to be typed, double-spaced, and should be no more than 5 pages each. Quantitative data need to be shown in tables or figures and qualitative data using images. Tables and figures should have descriptive legends. Please include your name, date, a title for the exercise, a statement of objective of the exercise, description of what you did, the results observed and a discussion of your results. Include complete citations of any references or websites consulted.

Presentation: Each student will be required to present their class assignment as a 20-35 minute PowerPoint presentation (length of time for presentation may depend on the number of students enrolled), allowing time for questions and answers by the audience. Each student will provide fellow students and instructor handouts of their PowerPoint presentation on the day it is scheduled.

Evaluation & Grades: (Students will be evaluated based on the following)

	<u>Points</u>	<u>Percentage of Grade</u>
Class attendance and participation	10	10%
Class assignment - written reports*	15	15%
Tests 2	15	15%
Project & presentation	30	30%
Final Exam	30	30%
Total:	100	

*The assignments, tests and the final exam will differ in their levels of difficulty between students attending the undergraduate and graduate sections of this course.

Grades for this course will be assigned according to established university policy.

90-100 = A 85-89 = B+ 80-84 = B 75-79 = C+ 70-74 = C 65-69 = D+ 60-64 = D <60 = E

Course policies and procedures

Grades and Grade Points: For information on current UF policies for assigning grade points, see <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>.

Attendance and Make-Up Work: Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>. Reports are due on the dates indicated in the instructions for each activity. Late homework will be accepted with a 20% penalty for each day after the due date. If you are having trouble with homework or class, please see me immediately. Test makeups will be arranged only in the case of an emergency and not for absences for any other reasons.

Safety: Follow all safety regulations in and out of the classroom.

Online Course Evaluation Process: Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open for students to complete during the last two weeks of the semester, students will be notified of the specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

Academic Honesty: As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: “*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity*”. You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit 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*”.

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code>.

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: The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation: 0001 Reid Hall, 352-392-8565, www.dso.ufl.edu/drc/

Campus Helping Resources: Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

University Counseling & Wellness Center, 3190 Radio Road, 352-392-1575,
www.counseling.ufl.edu/cwc/

Counseling services, groups and workshops, outreach and consultation, self-help library and wellbeing coaching.

U Matter We Care, www.umatter.ufl.edu/

Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Student Complaints:

Residential Course: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf

Online Course: <http://www.distance.ufl.edu/student-complaint-process>