PLS330 Principles and Techniques of Plant Propagation and Culture

Fall, 2019 Aug. 26th through Dec. 19th
Lecture Times: Monday and Wednesday 10:00am – 11:15am
Units: 3
Course fee: none

Instructor: Prof. Tanya M. Quist
Office: Forbes 317
E-mail: tquist@email.arizona.edu
Phone: 621-1582
Office hours: by appointment.

Course Description:

Plant propagation integrates art with science by applying principles of plant biology and cultural practices to create and multiply plants using seeds, cuttings, grafting, budding and tissue culture systems. While sexual seed propagation and all asexual techniques can be carried out in field or controlled environments, plant tissue culture requires specialized substrate, facilities and equipment to ensure sterile conditions. This course provides a comprehensive presentation of principles, techniques and systems used in plant propagation and culture. Students will learn both the techniques and biological concepts as they apply to sexual and asexual reproduction. Students will also study cultural practices and environmental controls important to plant production in field and container systems, as well as the special environmental controls needed for sterile culture techniques.

Learning Objectives:

This course aims to provide students with a basic understanding of principles, practices and applications of plant propagation and plant culture including:

- Basic principles of plant biology and physiology.
- Propagation techniques for seeds, cutting, budding, grafting and micropropagation.
- Environmental control and cultural practices applied to propagation systems and micropropagation protocols.

Learning Outcomes:

After completion of this course, students will be able to:

- Define biological principles relevant to plant sexual and asexual reproduction including seed, cutting, grafting, budding and micropropagation techniques of shoot and nodal culture, organogenesis and non-zygotic embryogenesis.
- Briefly describe the relevance of various seed and clonal propagation approaches used in modern production and research.
- Describe the effects of environmental and edaphic factors as well as the influence of developmental stage and physiological state on the successful regeneration of plants by sexual and asexual means.
- Compare and contrast the techniques, equipment and cost for propagation and plant culture used in field, greenhouse and other controlled growth facilities.

- Outline plant tissue culture practices used in production and research including aseptic technique, preparation of culture and selection media, criteria for choosing an explant and regeneration system as well as the use of growth regulators *in vitro*.
- Apply knowledge of propagation and culture techniques to solving challenges in plant conservation, plant improvement through traditional and molecular breeding, production of biopharmaceuticals, discovery of gene function, molecular and physiological mechanisms, regeneration of transgenic plants, production and rescue of embryos or sterile hybrids and production of virus free stock plants.

Textbooks:

Hartmann, Kester, Davies & Geneve (2002) *Hartmann and Kesters' Plant Propagation: Principles and Practices*, 7th edition. Prentice Hall. (An accompanying CD provides additional information on more than 200 terms used in plant propagation.)

Course Management:

This class is administered through http://D2L.arizona.edu. Students are responsible to check the D2L course site daily for updates and news. Lectures will be posted prior to class for students to review in advance. Reminders of assignments, deadlines, updates/news, as well as links to supplemental resources will also be posted here.

Assessments and Grade Structure:

Exam I	100
Exam II	100
Exam III	100
Final Exam III	100
Group Work(10)	50
Homework	75
Attendance (5)	125
	650 total points possible

A>	90%
B>	80%
C>	70%
D>	60%
E<	59%

WEEK	DAY	#	TOPIC	Assignments
1	M	1	Overview - Sexual and Asexual Propagation	Ch. 1, 2
	W	2	Seed Development	113-131
2	M	3	Seed Germination	199-218
	W	4	Seed Dormancy	220-241
3	M		Labor Day – No classes	
	W	5	Seed Certification and Storage	154, 188-194
4	M	6	Plant Breeding Systems I (Self-, cross-pollination)	141-146
	W	7	Plant Breeding Systems II (Apomixis)	131-133, 146
5	M	8	Asexual Propagation Methods I	342-357
	W		EXAM I	

6	M	9	Asexual Propagation Methods II	342-357
	W	10	Cutting Biology- Adventitious Organ Formation	277-304
7	M	11	Manipulating Adventitious Organ Formation	304-329,367-74
	W	12	Production and Management of Cutting Clones	357-367
8	M	13	Plant Growth Regulators	367-374
	W	14	Clonal Selection	592-608
9	M	15	Specialized Stems and Roots I – Biology	574-586
	W	16	Specialized Stems and Roots II - Structures	574-586
10	M		EXAM II	
	W	17	Introduction to and Relevance of Tissue Culture	690-710
11	M	18	Tissue Culture Facilities and Procedures	690-710
	W	19	Tissue Culture Systems	651-667
12	M	20	Tissue Culture Applications-Research & Production	TBD
	W	21	Practical Challenges of Tissue Culture	673-679
13	M		EXAM III	
	W	22	Introduction to Grafting	411-420
14	M	23	rafting Techniques	463-491
	W	24	Grafting - Stock/Scion Interactions I	463-491
15	M	25	Grafting - Stock/Scion Interactions II	448-454
	W	26	Grafting Production Processes	491-504
16			FINAL EXAM – TBA	

Assessments and Grading Policies:

Three exams will be administered during lecture period throughout the semester. Each exam will assess learning of the reading material, and lectures, and labs associated with topics outlined on the syllabus. Students are responsible to arrange an alternative exam time with the professor prior to the exam if an absence on the scheduled dates is unavoidable. Without prior notice of an absence, students will not receive opportunity for a make-up exam.

Class time will focus on student-centered collaborative learning activities. The expectation is that students review lessons before class as preparation for in-class activities. Classroom activity will be formative and summative. Summative assessments will count toward participation points.

Homework assignments will also provide summative assessment. These are described below. Assignments turned in after the deadline will lose 10% per day from the total points possible after the deadline and will not be accepted if turned in three days late without explanation.

- Assignment 1 (25pts): Students are asked to use sources provided and additional primary literature available to research and fully describe the practices employed for propagating a specific native or cultivated plant taxa that they will be assigned. The research must include the morphological, ontogenetic developmental, physiological, and environmental factors important in the propagation or culture protocol of the assigned species. The report must also include a description of edaphic factors such as substrate/media, growth regulators and their formulation as well as any specialized tools and equipment needed.

- Assignment 2 (50pts): Students will apply their knowledge of propagation and culture to explain how these techniques are used to solve a specific challenge in plant conservation, plant improvement, or basic research. The report must describe the specific technical protocol used for propagation, a full description of the nature and context of the challenge, along with justification of the propagation solution.

Incomplete Policy:

Any incomplete grade given must be verified with a written agreement with the student that specifies the work to be done and a timetable for completion. In accordance with University policy, the grade of Incomplete (I) can only be awarded in cases of students whose circumstances prevent them from finishing the required work for the course.

Absence Policies:

All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored. Be advised that laboratory exercises will include several required field trips, but will be convened during the designated lab time.

Course Withdrawal:

Students withdrawing from this course must notify the instructor prior to nonattendance in classes, and must execute drop or withdrawal procedures in accordance with the UA General Catalog. See the link on attendance and administrative drop. http://catalog.arizona.edu/2008_09/policies/classatten.html
Failure to attend and participate in class does not drop you from the class. Enrolling and then failing to complete the course will result in a failing grade. However, if you have concerns and are unlikely to complete course requirements please see the instructor or your academic advisor to officially withdraw from the course. This will minimize the impact to your GPA and increase the chances for readmission to the university if you withdraw completely or take a leave of absence.

Classroom Policies:

Students are expected to attend all lectures and labs. Students are expected to be respectful and avoid creating distractions that disrupt the learning environment. Cell phone use in class is prohibited. Laptops to support note-taking are acceptable. This course will observe University policy relating to threatening behavior by students: http://policy.web.arizona.edu/threatening-behavior-students

Academic Integrity:

Sharing of intellectual views, discussion of course principles and applications are encouraged. However, quizzes, and the final exam must be executed independently. It is the student's responsibility to be familiar with and adhere to the rules for academic behavior discussed in the Code of Academic Integrity http://catalog.arizona.edu/2010-11/policies/aaindex.html. If you have any questions, contact the instructor. In turn, instructors commit to maintain the anonymity of individual student grades.

Campus Emergencies:

In the event of a major campus emergency, course requirements, deadlines and the grading system as outlined here are subject to changes necessitated by a revised semester calendar or other circumstances beyond the

instructor's control. Check D2L Announcements to get current information about changes in this course. Alternatively you may contact the instructor by phone or email.

Special Needs and Accommodations:

Students needing special accommodations or special services should contact the Learning Disabilities Programs/SALT, Old Main Bldg. (621-1242), http://www.salt.arizona.edu and/or the Center for Disability Related Resources, 1540 E. Second St. (621-3268). The needs for specialized services must be documented and verified by one of these units. Accommodation will be made in class to enhance your learning experience. Please contact the instructor within the first two weeks of class and provide necessary paperwork to discuss accommodations.

Student Confidentiality:

All UA classes fall under the guidelines of the Federal Education Rights and Privacy Act.

Syllabus Changes:

The instructor reserves the right to change the syllabus as the needs of the class dictate. Any changes will be posted on D2L Announcements or announced during class/lab. It is your responsibility to be informed on changes to the syllabus and calendar.

Writing Assistance:

The Writing Skills Improvement Program (WSIP) offers free professional writing assistance for UA undergraduate and grad students. Students work one-on-one with staff members (all of whom have Masters or Ph.D. degrees in addition to college teaching experience) on writing for any class, at any stage of the writing process. WSIP also offers free weekly writing workshops open to the entire university community, with no preregistration required. For more information, call 621-5849 or visit the website at http://wsip.web.arizona.edu