

**Spring 2020**

**PLS 475A Applied Plant Physiology (3 units)**

**Course Description:**

In this course, students will learn the major environmental factors affecting plant growth and development and will understand interactions between plants and their microenvironments, including light penetration and gas exchange. Students will be guided in exploring phenomena and situations relating to agricultural production, review relevant principles of plant physiology and apply basic plant physiology principles to understand plant productivity in field and controlled environment systems. Students are expected to prepare in advance of class time and interact in collaborative learning during class period. Class time will also provide focused instruction covering principles of plant physiology and critical evaluation of applications of these principles in agronomic and horticultural crop production. Production practices considered will include in fields, greenhouses, plant production factories, and tissue culture vessels.

**Course Prerequisites:**

Undergraduate plant biology (required) or permission of instructor. Concurrent enrollment in basic plant physiology PLS360 is acceptable.

**Location and Times:**

Jan. 15 to May 6 | Monday and Wednesday 9:30 am-10:45pm | Shantz Room 247

**Instructor:** Prof. Tanya M. Quist

Office: Forbes Room #317

Email: [tquist@email.arizona.edu](mailto:tquist@email.arizona.edu)

Phone: 621-1582

Office Hours: anytime by appointment.

**Course Objectives:**

This course aims to provide students with a review of the basic principles and processes governing plant physiological function. The course will guide students in application of their knowledge of plant physiology to crop production and management systems and provide experience using current scientific literature to predict the influence of environmental factors on plant growth and development.

**Learning Outcomes:**

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

- I. Define relevant terminology and techniques used in controlled environment agriculture, horticultural and agronomic field production.
- II. Understand and be able to describe general mechanisms involved in plant responses to environmental conditions in field and controlled environment agriculture settings.
- III. Compare and contrast plant physiological development, growth, and yield responses in different production systems.
- IV. Evaluate scientific literature covering principles and applications of plant physiology to production systems.

**Textbook (optional):**

**There is no required textbook for this class.** The following books are listed here as resources. They are recommended but are not required:

Victor O. Sadras and Daniel Calderini (2015) Crop Physiology, Second Edition: Applications for Genetic Improvement and Agronomy. Elsevier, Inc.

Hanan, J.J.1998. Greenhouses. Advanced Technology for Protected Cultivation.

CRC Press.  
Jones, H.G. 2014. Plants and microclimate. A Quantitative Approach to Environmental Plant Physiology (3rd edition). Cambridge University Press.

**Examinations:**

There will be a midterm examination and a final examination.

**Grading Policy:**

Grade for the course will be based on points accumulated over the course of the semester (>90%=A; >80%=B; >70%=C; >60%=D; <59%=E). Total possible points obtained are 500 pts. These points will be awarded based on attendance, class participation, participation in peer review, 2 exams, homework and quizzes.

Attendance (27 x 5)	135
Class participation (10 x 10)	100
Peer Reviews* (2 x 20)	40
Homework (5 x 20)	100
Midterm exam	100
Final exam	100
Total	575 points

\*Includes equally weighted grades from instructor and a peer reviewer.

Incomplete Grade Policy <http://registrar.arizona.edu/grade政策/incomplete.htm>

**Teaching Format:**

The course will be provided in a collaborative learning environment. The expectation is that students will actively engage in learning in and out of the classroom. Each meeting will include lecture materials (available for student access on the D2L course website), activities,

**Classroom Behavior:**

Policy regarding use of cell phones/pagers – prohibited during instruction sessions. The Arizona Board of Regents' Student Code of Conduct <http://web.arizona.edu/~policy/threatening.pdf>, ABOR Policy 5-308, prohibits threats of physical harm to any member of the University community, including to one's self. See: <http://policy.web.arizona.edu/~policy/threaten.shtml>.

**Special Needs and Accommodations Statement:**

Students who need special accommodation or services should contact the Disability Resources Center, 1224 East Lowell Street, Tucson, AZ 85721, (520) 621-3268, FAX (520) 621-9423, email: [uadrc@email.arizona.edu](mailto:uadrc@email.arizona.edu), <http://drc.arizona.edu/>. You must register and request that the Center or DRC send me official notification of your accommodations needs as soon as possible. Please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate. Specific accommodation recommendations must be provided to the instructor through the DRC.

**Student Code of Academic Integrity:**

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/codeofacademicintegrity>

**Confidentiality of Student Records:**

<http://www.registrar.arizona.edu/ferpa/default.htm>

**Subject to Change Statement:**

Information contained in the course syllabus may be subject to change with advance notice, as deemed appropriate by the instructors.

### Spring 2020 Course Schedule

Week	Date	Topics	
1	Jan 15 W	Course Overview	
2	Jan 22 W	Significance of Applied Plant Science Research M1	Partic. 1
3	Jan 27 M	SI Units: Standardizing Data Communication M2	HW 1
	Jan 29 W	Overview of Plant Environmental Responses	
4	Jan 24 M	Light: Introduction M3	Partic. 2
	Jan 29 W	Light: Intensity and Photosynthesis M3	
5	Feb 3 M	Light Quality: Regulation of Plant Growth & Development M3	Quiz 1
	Feb 5 W	Light: Photoperiod M4	Partic. 3
6	Feb 10 M	Light: Supplemental Lighting Controlled Environments M4	
	Feb 12 W	Plant Response to CO <sub>2</sub> M5	Quiz 2
7	Feb 17 M	Plant Responses to Wind M6	HW 2
	Feb 19 W	Plant Responses to Temperature M7	
8	Feb 24 M	Plant Responses to Temperature M7	Partic. 4
	Feb 26 W	Plant Responses to Humidity M8	
9	Mar 2 M	TBD	
	Mar 4 W	Midterm Exam	Exam
10	Mar 9-13	Spring Break - no class	
11	Mar 16 M	Temperature, Radiation & Leaf Energy Balance M9.1	Partic. 5
	Mar 18 W	Light and CO <sub>2</sub> Diffusion in the Canopy M9.2	HW 3
12	Mar 23 M	Canopy Light: Distribution Modeling M10.1	
	Mar 25 W	Canopy Light: Management in Controlled Environments M10.2	Partic. 6
13	Mar 30 M	Plant Nutrition: Rootzone Nutrients M12	Peer Review
	Apr 1 W	Adaphic Conditions: Rootzone Substrate M13	
14	Apr 6 M	Plant Water Relations M14	HW 5
	Apr 8 W	Translocation of Photosynthates M15	Partic. 7
15	Apr 13 M	Growth Analysis M16	
	Apr 15 W	Crop Growth and Yield: Carbon Partitioning M17	Partic. 8
15	Apr 20 M	Greenhouse Environments M18.1	
	Apr 22 W	Energy balance in Greenhouses M18.2	Partic. 9
16	Apr 27 M	Environments of Other Production Systems M19, 20	HW5
	Apr 29 W	Tissue Culture and In Vitro System Environments M21	
17	May 4	TBD	Partic. 10
	May 6	Final Review	

**Sample Activities and Assessment Associated with Learning Objectives:**

- I. Be able to define relevant terminology and techniques used in controlled environment agriculture, horticultural and agronomic field production.
  - Learning Activity: Define terms individually,
  - Assessment: students will complete a quiz individually through D2L outside of class. In class, students will work in small groups in a round robin to define key terms. They will then discuss, participate in clicker questions and then present a summary of terms to the class. Results will be shared on google docs. All students will then be given another attempt at the D2L quiz after class.
- II. Understand and be able to describe general mechanisms involved in plant responses to environmental conditions in field and controlled environment agriculture settings.
  - Learning Activity: students complete a one-minute essay describing their understanding of a mechanism controlling plant response to a specific environmental factor.
  - Assessment: students will participate in an informal peer review of a partners essay and then work in a small group to discussion and diagram the mechanistic process. Group work concludes by presenting and describing the diagram to the class using a white board and an overhead projector.
- III. Compare and contrast plant physiological development, growth, and yield responses in different production systems.
  - Learning Activity: Think-Pair-Share – students work individually to interpret graphs showing physiological responses to growth in differing environments. They discuss in pairs and share a summary with a small group.
  - Assessment: The small group completes a written summary of their findings that is graded.
- IV. Be able to evaluate scientific literature covering principles and applications of plant physiology to production systems.
  - Learning Activity: Students are assigned to read articles individually out of class and prepare a summary of the topic so that they may act as the expert on that topic in small group work in class.
  - Assessment: Using a Jig saw approach, individuals students arranged in small groups are asked to collaborate by sharing expertise needed to predict the physiological implications of scenarios in which an environmental parameter is manipulated within a specific production system. Students present their work to the class and this is peer reviewed guided by a formal grading rubric\*. The individual summary of the articles read will also be submitted to the instructor for a grade.

## Peer Review Rubric

	1	2	3	4	Wt	Total
<b>Specific feedback</b>	Feedback is vague and rambling and provides little to no guidance to recipient	Feedback is vague or rambling; statements such as "good job" is stated	Feedback is mostly specific but vague in some areas	Feedback is concise and contains precise details to guide recipient	<b>3</b>	<b>12</b>
<b>Correct suggestions</b>	>1 major or > 3 minor errors in feedback	Either 1 major or 2-3 minor errors in feedback	1-2 minor errors in feedback	No errors in feedback	<b>1</b>	<b>4</b>
<b>Professional language and tone</b>	Unprofessional, belittling or hurtful language or tone	Mixed professional and unprofessional language or tone	Professional language and tone throughout	Professional language and tone throughout with clear effort to assist recipient	<b>1</b>	<b>4</b>
<b>Grammar/ Spelling</b>	>5 grammatical or spelling errors	3-5 grammatical or spelling errors	1-2 grammatical or spelling errors	No grammatical or spelling errors	<b>0.5</b>	<b>2</b>
<b>Total</b>					<b>/ 20 points possible</b>	

Grading accuracy: >20% variance from course instructor assessment will result in a grade of zero for the peer review participation grade.