

CROP GROWTH AND DEVELOPMENT (AND IMPROVEMENT)**Goals:**

Students will be provided with knowledge on basic scientific principles of crop growth and development, including external abiotic (light, temperature, water, and nutrients) influences and their interaction with internal influences (genes, proteins, and hormones) from the cellular to the whole plant level. Consideration of how the application of such scientific knowledge has and can lead to crop improvement for efficient and sustainable crop production will be emphasized. Skills in quantitative reasoning, scientific teamwork, and research communication (written, visual, and oral) will be introduced and fostered. Students will be exposed to different WSU programs to learn more about crop improvement through plant breeding. Students will gain an appreciation of and access to knowledge sources for crop growth and development principles and practice – literature and other written sources, WSU faculty and other experts, and other WSU courses. **Please thoroughly read this course syllabus and maintain a copy on your laptop or in your notebook to refer to as needed.**

Instructors: (Office hours for all: by appointment)

Dr. Desmond R. Layne, 137 B Johnson Hall, 335-6647, desmond.layne@wsu.edu

Teaching Assistant (Pullman Lab): James Crabb, jamescrabb@wsu.edu

Teaching Assistant (Pullman Lab): Ashley Powell, sunshinebella@wsu.edu

Teaching Assistant (Tri-Cities Lab): Robb Zimmer, robb.zimmer@wsu.edu

Class Meeting Times:

Lecture: Pullman - MWF 9:10–10:00 am, FSHN T101

Tri-Cities – MWF 9:10-10:00 am, Wine Science Center #202

Lab: Pullman – Tue 9:10–11:50 am or 1:25–4:05 pm, Vogel Plant Sciences Bldg. 35

Tri-Cities – Mon 1:10–4:00 pm T East 142

Blackboard: You can access the course by logging into <https://learn.wsu.edu> and then finding the course ID in the list in the My Courses module. The AMS video conference course id is: 2016-spri-PULLM-HORT-202-4963-LEC. The video lecture recordings will be available under the Class Recordings link on the course menu.

Prerequisites: HORT/CROP_SCI 102

Required text book

Hartmann's Plant Science: Growth, Development, and Utilization of Cultivated Plants by M. McMahon, A. Kofranek, and V. Rubatsky, Pearson Prentice Hall. Fifth edition.

This is the same text as for HORT/CROP_SCI 102, and is the main source of course content. You are expected to read appropriate pages prior to each lecture block and class.

Expected student learning outcomes:

Through engagement in class, lab activities, group projects, and field trips, students will:

- Apply basic scientific principles of how plants grow and develop to understanding crop quality and yield.
- Evaluate how scientific knowledge enables improved crop production.
- Investigate areas of interest in crop growth and development for crop improvement, integrating knowledge sources and demonstrating skills in quantitative reasoning, research communication, and teamwork.

LECTURE SCHEDULE

Week	Date	Lecture block		
1	Jan	11 M	Crop Improvement - Introduction	Block I
		13 W	Crop Improvement - Introduction	
		15 F	Crop Improvement - Introduction	
2		18 M	University Holiday (Martin Luther King Jr. Day)	
		20 W	Crop Improvement - Introduction	
		22 F	Crop Improvement - Introduction	
3		25 M	Patterns of Plant Growth & Development	Block II
		27 W	Patterns of Plant Growth & Development	
		29 F	Patterns of Plant Growth & Development	
4	Feb	01 M	Patterns of Plant Growth & Development	
		03 W	Patterns of Plant Growth & Development	
		05 F	Patterns of Plant Growth & Development	
5		08 M	Plant Structure & Function	Block III
		10 W	Plant Structure & Function	
		12 F	Plant Structure & Function	
6		15 M	University Holiday (President's Day)	
		17 W	First Mid-Term Exam (50 min.)	
7		19 F	Plant Structure & Function	
		22 M	Plant Structure & Function	
		24 W	Plant Structure & Function	
		26 F	Plant Structure & Function	
8	Mar	29 M	External Influences	Block IV
		02 W	External Influences	
		04 F	External Influences	
9		07 M	External Influences	
		09 W	External Influences	
		11 F	External Influences	
10		14-18	Spring Break	
		21 M	External Influences	
		23 W	External Influences	
11		28 M	Second Mid-Term Exam (50 min.)	
		30 W	External Influences	
12	Apr	01 F	Crop Propagation	Block V
		04 M	Crop Propagation	
		06 W	Crop Propagation	
		08 F	Crop Propagation	
13		11 M	Crop Improvement - Advanced	
		13 W	Crop Improvement - Advanced	
		15 F	Crop Improvement - Advanced	
14		18 M	Crop Improvement – Advanced – Guest lecture (A. Carter)	Block VI
		20 W	Crop Improvement – Advanced – Guest lecture (K. Evans)	
		22 F	Crop Improvement - Advanced	
15		25 M	Crop Improvement - Advanced – Team Project poster presentations	
		27 W	Crop Improvement - Advanced – Team Project poster presentations	
		29 F	Crop Improvement – Advanced – Team Project poster presentations	
exam week	May	04 Wed	Final Exam (3 hours, 7–10 am)	

Lecture block	Textbook chapter	Lecture topics
I Crop Improvement – Introduction	1, (10)	Course outline and assessment, crop domestication, production trends, why improve crops?
II Patterns of Plant Growth & Development	7	Growth patterns, phase changes, annuals, biennials, perennials, harvest index, flower, fruit, and seed growth and development patterns
III Plant Structure & Function	(9), 8, 6, 11, 12, (13), (7)	Plant chemicals, cell components, permanent tissues, meristems, seeds, roots, stems, buds, leaves, flowers, fruit, photosynthesis, respiration, plant hormones
IV External Influences	(7), 14, 15	Perception of external stimuli - light, temperature, water, nutrients, biotic factors
V Crop Propagation	9	Mitosis, meiosis, inheritance, pollination, fertilization, seed propagation, vegetative propagation
VI Crop Improvement - Advanced	10, (9)	Genetic diversity, breeding, Integration of cultural practices and genetic techniques for crop improvement, student Team Project poster presentations

LABORATORY SCHEDULE

Dates below are for Pullman (Tuesday's). Tri-Cities class meets on Monday afternoons.

[Note: Activities/field trips in Tri-Cities that differ from those noted below will be communicated by TA]

No.	Date	Laboratory topic	Team Project
1	Jan 12	Introduction, greenhouse visit	Review posters; discuss team projects Hand out project interest worksheet which is Due in lecture period on 1/15
2	19	Library Orientation; mutant corn experiment start	Assemble into teams Due: project interest worksheet
3	26	Seed germination experiment starts	Start seeds. Due: List of materials
4	Feb 02	Project Design Review	Due: Team member task list and scientific reference list
5	09	Seed germination discussion	
6	16	Plant hormones	Due: Introduction, Materials & Methods draft for poster
7	23	Vegetative propagation	
8	Mar 01	Tree Fruit DNA Testing	
9	08	Wheat Breeding Greenhouse Tour	
	15	Spring Break (no lab)	
10	22	Mutant sweet corn GA lab results	Work on group projects
11	29	Data presentation methods discussion	
12	Apr 05	Tukey Orchard Tour	Due: Results (graphs/tables/images) draft
13	12	Organic Farm Tour	Due: Discussion & Conclusions and overall poster layout draft
14	19	Merry Cellars Tour	Due: Final posters, teamwork evaluation
15	26	Team Project Presentation	Final greenhouse clean up

TEAM RESEARCH PROJECTS

You will work in teams of 4-5 persons to research, implement, analyze, document, and communicate your information on a research project related to crop growth and development. Besides taking theory from the classroom and applying it to your hands-on team project, you will also hone critical thinking, teamwork, and communication skills. This will be useful for future courses, possible internships, and even jobs. It might even spark an interest in you for advanced research training in graduate school to become a scientist.

Your experiments will be conducted in the course assigned greenhouses under your own direction. The Pullman Horticulture greenhouses are located between Ferdinands's ice cream shop and the football indoor practice field. The doors are generally unlocked and you can access your plants between 7 am – 4 pm during Monday-Friday. For after hours access, please contact the lab TA. Past years' team projects, ideas, and guidelines will be provided during the early lab sessions of the semester. You will work in a team on one crop of your choice ranging from wheat, turfgrass, radish, tomato or apple. You will grow your crops from seeds. Your project will utilize two genetically distinct cultivars so that cultivar differences can be compared. We will help you to decide on the experimental treatments that you will impose to compare their influences on your crop's growth and development. Ideally, experimental treatments that are chosen should result in different plant growth responses over the course of the experiment.

Your project team will be responsible for routine greenhouse tasks such as plant care (e.g., watering, fertilizing, staking, transplanting, overall maintenance), applying experimental treatments, taking growth measurements, analyzing data and preparing a final research poster to present to the class. Consider the TA's as mentors who will advise you so that you can successfully conduct your research and present it professionally. However, this is your project and your responsibility to complete it as a team.

We will provide you with a standard poster presentation template that you can populate it with content as noted below to get feedback from us prior to submitting your final project.

The **190** points assigned for the research project will be distributed as follows:

5 – Project interest worksheet (turn in during lecture)	--- due 15 Jan
5 – List of materials for project	--- due 26 Jan
10 – Team member task list and scientific reference list	--- due 2 Feb
10 – Introduction and Materials & Methods drafts	--- due 16 Feb
10 – Results (graphs/tables/images) draft	--- due 5 Apr
10 – Discussion & Conclusion and overall poster layout draft	--- due 12 Apr
80 – Final poster	--- due 19 Apr
10 – Teamwork evaluation based on task list	--- due 19 Apr
50 – Presentation of final poster to class	--- week of 25-29 Apr

Note: Instructor/TA's reserve the right to adjust individual grades for team projects based on actual participation.



ASSESSMENT

700 pts total

425 pts Lecture

– Two mid-term exams, writing assignments, final exam

275 pts Lab

– Team Projects, participation in other lab activities and write-ups

Lecture (425 pts total):

100 pts Writing assignments (four, 25 pts. each)

100 pts First Mid-term exam

100 pts Second Mid-term exam

100 pts Final exam

25 pts Attendance

Lab (275 pts total):

190 pts Team Research Project

60 pts Lab Assignments and field trip write-ups

25 pts Attendance

Grading scale

100 - 93% = A

86 - 83% = B

76 - 73% = C

65 - 60% = D

92 - 90% = A-

82 - 80% = B-

72 - 70% = C-

≤59% = F

89 - 87% = B+

79 - 77% = C+

69 - 66% = D+

Exams cannot be made up if missed. The three exams have equal weight. Each in-class exam will be “closed book” and cover approximately 1/3 of the total course content. You will not have access to any electronic devices, notes, etc. while taking the exams. No final exam exemptions will be made. The **first** mid-term exam will include any information covered in lecture, lab, textbook or other activities during Jan. 11 – Feb. 16; the **second** mid-term exam will include any information covered in lecture, lab, textbook or other activities during Feb. 19 – March 25. The **final** exam will include any material covered in the lecture, lab, textbook or other activities during March 29 – April 29. Exam answer keys will be posted on Blackboard after exams have been graded. You should review the answer key to determine how points were assigned based on your answers. If you have any questions about your exam grade, you must first review the exam answer key to see what was expected. If questions remain, please contact the TA or instructor for review.

Writing Assignments – These will be communicated throughout the semester with a specified deadline noted and a grading rubric to guide your preparation.

“Extra Credit” - At the discretion of the instructor, there may be one or more opportunities to earn extra credit during the semester. These will be communicated to the entire class with clear instructions and deadlines.

Lecture Expectations – Before coming to class you are strongly recommended to (1) read the indicated textbook material (2) read/view the PowerPoint slides provided on Blackboard, and review any additional material that you are directed to by the instructor. Failure to attend any given lecture may put you at a disadvantage when exams are given because there may be occasional tips given to the class about how to study, what a good question might be, etc. As noted elsewhere in the syllabus, the lectures are recorded, so that you can review a missed lecture should that be necessary.

Classroom Etiquette - Be respectful of your instructor, speakers, and fellow classmates by refraining from text messaging, Facebook, online social media, newspapers, games, etc. during class time. Such activities are a distraction to those around you, and have no place in a lecture

classroom. Please silence and put away your cell phone during class. For note taking purposes in class, you are free to use whatever method you prefer (laptop, tablet, pen/paper, etc.).

Lab Expectations – There will be a lab preview available on Blackboard each week that you should review prior to coming to lab. Any additional pertinent lab information will be posted on **Blackboard** so please check this regularly. For an excused absence to the lab, see TA in advance only for an alternative option for graded lab assignment or write-up.

Attendance – Attendance in lecture and lab sessions is expected, will often be recorded, and it will represent part of your final class grade. Absences because of illness, personal and/or family crises, mandated court appearances, or similar reasons will be accommodated as long as such absences are not excessive and notification is provided to the instructor or TA in advance. Excused absences should be arranged prior to any known or planned event. Required University activities will be excused absences if an official Class Absence Request form signed by the sponsoring faculty/organization is given to the Instructor (if for lecture) or TA (if for lab) before the event.

Online Information - Blackboard

The online course page can be accessed via Blackboard at learn.wsu.edu. **Please check this site frequently for lecture and lab information.** Other course information such as detailed assignment information and lecture schedules are also available on Blackboard. Recordings of class lectures are also available through learn.wsu.edu.

Communications From Instructor/TA's - Information regarding exams, assignments, project, schedule changes, or changes to the syllabus will occasionally be communicated by e-mail and posted on **Blackboard**. E-mails will be sent to your @wsu.edu account. **Check your email frequently.** If you are using a different primary email address (e.g., @gmail.com, @yahoo.com, etc.), please be sure that your @wsu.edu messages are successfully **forwarded** to your primary e-mail account and that you read messages related to HORT/CROP_SCI 202.

Disability statement

We are committed to providing assistance to help you be successful in this course. Reasonable accommodations are available for students with a documented disability. Please go to the Disability Resource Center (DRC) during the first two weeks of the semester to seek information or to qualify for accommodations. All accommodations **MUST** be approved through the DRC, located in the Administration Annex Bldg, Room 205. To make an appointment with a disability counselor, please call 335-3417.

Cheating (WAC 504-25-310)

Cheating is the intentional use of, or attempt to use, unauthorized material, information, or study aids in any academic activity to gain advantage. Cheating includes, but is not limited to, communicating improperly with others, especially other students, during tests or the preparation of assignments for classes; copying from books, notes, or other sources during a test when this is not permitted; copying from another student's work (reports, laboratory work, computer programs, files, etc.); making improper use of calculators or other devices during a test; illegitimately procuring or using copies of current examinations; allowing a substitute to take an examination or write a paper for oneself.

Plagiarism (WAC 504-25-310)

Plagiarism is knowingly representing the work of another as one's own, without proper acknowledgment of the source. The only exceptions to the requirement that sources be acknowledged occur when the information, ideas, etc., are common knowledge. Plagiarism includes, but is not limited to, submitting as one's own work the work of a "ghost writer" or work obtained from a commercial writing service; quoting directly or paraphrasing closely from a source without giving proper credit; using figures, graphs, charts, or other such material without identifying the sources.

Academic Integrity Processes (WAC 504-25-315)

Every act of academic dishonesty affects academic evaluation of the student and also is a violation of the University's standards of conduct. Responsible instructors retain the authority and responsibility to assign grades to students, considering from an academic standpoint the nature of the student's action. This is the case even when the case is referred to the University Academic Integrity Process. Students have recourse to appealing the responsible instructor's assignment of grades according to usual academic policy. See Academic Regulation 104. All clear instances of academic dishonesty shall be reported to the Office of Student Conduct as outlined in 504-35-335(2). The first reported instance at WSU of academic dishonesty by a student will be treated as purely an academic matter unless, in the judgment of the responsible instructor, more serious action should be taken through the disciplinary process. Any allegation of subsequent academic dishonesty will be treated as a matter to be referred to the Office of Student Conduct.

Any course-related materials, presentations, lectures, *etc.* are the instructor's intellectual property and may be protected by copyright. Selling class notes through commercial note taking services, without the written advance permission of the course instructor, could be viewed as copyright infringement and/or an academic integrity violation, WAC 504-26-010 (3)(a,b,c,i). Further, the use of University electronic resources (*e.g.*, Blackboard) for commercial purposes, including advertising to other students to buy notes, is a violation of WSU's computer abuses and theft policy (WAC 504-26-218), a violation of WSU's Electronic Communication policy (EP 4), and also violates the terms of use for the Blackboard software program. Another important consideration regarding commercial note-selling is the educational value of such an activity. Notehall.com, for example, assumes zero liability for the content on its site. There is no guarantee the information is factual or even pertains to the class discussion. Purchasers have no assurances of the quality of what they are buying.

Reports of Academic Dishonesty (WAC 504-35-320)

Any member of the University community who witnesses an apparent act of academic dishonesty shall report the act either to the instructor responsible for the course or activity or to the Office of Student Conduct.

Classroom Safety

Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the "**Alert, Assess, Act**" protocol for all types of emergencies and the "[*Run, Hide, Fight*](#)" response for an active shooter incident. Remain **ALERT** (through direct observation or emergency notification), **ASSESS** your specific situation, and **ACT** in the most appropriate way to assure your own safety (and the safety of others if you are able).

Please sign up for emergency alerts on your account at [MyWSU](#). For more information on this subject, campus safety, and related topics, please view the [FBI's Run, Hide, Fight video](#) and visit the [WSU safety portal](#).