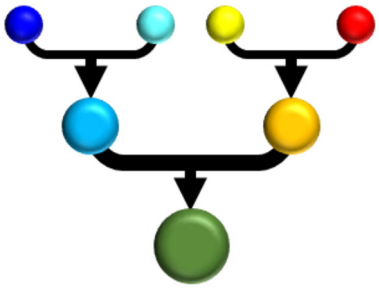
Course Syllabus

HORT 345

Crop Plant Genetics

Fall 2024

3 credits



Key principles of genetics for crop plants, covering: Mendelian, transmission, population, and quantitative genetics; the genetic consequences of types of reproductive systems; genetic diversity sources and resources; and the applied crop plant genetics areas of biodiversity management, breeding, and on-farm cultivar choice and management. Integration of crop plant genetics in the broader context of crop improvement.

No pre-requisites (although HORT/CROP_SCI 202 is recommended).

Face-to-face instruction in Pullman.

Monday classes recorded, Wednesday and Friday classes not recorded.

Four Saturday field trips through semester. First one on Sat 24 Aug.

Class Meetings

M W F 12:10—1:00 pm

Location: Clark 149

Field trips 1:00—5:00 pm some Saturdays

Meeting points to be announced

Instructor

Dr. Cameron Peace

3031 IT Building, Pullman

cpeace@wsu.edu (mailto:cpeace@wsu.edu)

Office hours: M W 1-2 pm in Clark 245, and otherwise by appointment

Textbook and Course Materials

Required textbook: Principles of Plant Genetics and Breeding by George Acquaah (3rd ed., ISBN: 978-1-119-62632-9, Dec 2020, Wiley-Blackwell; 2nd ed. is also suitable). Available from the Bookie. Note that this textbook is also used for HORT/CROP_SCI 445 Plant Breeding (for which 345 here is a pre-requisite). Details of textbook pages for each class are at **this link (https://wsu.instructure.com/courses/1733854/files/122830744?wrap=1)** **(https://wsu.instructure.com/courses/1733854/files/122830744/download?download_frd=1)** .

Additional learning resources will be provided online within each Module, brought to class, or visited during and outside class periods.

No course fees.

Student Learning Outcomes

Course Goal: Students will be engaged in the key principles of genetics for crop plants. Students will know how crop plant genetics is integrated in the broader context of crop improvement and is relevant to their future professional careers.

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

1. Explain the major principles and consequences of inheritance in the crop plant system
   (Integrated Plant Sciences SLO: Plant Systems)
2. Integrate knowledge and skills in genetics and statistics to describe how experiments are designed, conducted, and interpreted to test hypotheses involving crop plant genetic differences
   (Integrated Plant Sciences SLO: Scientific Reasoning)
3. Recognize genetics principles in contemporary scenarios of cultivar choice and management, breeding, and germplasm management and apply them in newly encountered crop improvement scenarios
   (Integrated Plant Sciences SLO: Critical Thinking)

Learning Methods

A range of learning materials will be used (this is because education research has demonstrated such an approach improves inclusivity and enhances engagement – thus it promotes learning for each of you in the course). Assessment will be on individual student submissions of work items. Some in-class and homework work in pairs or small groups will serve to provide peer support. The textbook and posted lecture slidesets are the theoretical basis of the course's content. Experiences in utilizing this theory will occur most weeks, to strengthen your crop plant genetics skills and understanding. Canvas will serve as the course space, housing this syllabus, lecture slidesets, class recordings, additional learning resources, assignment descriptions, assignment submission portals, assignment feedback, exams, grades, discussion boards, and the communication avenue for most course announcements outside of class.

The course is presented to you in five Sections:

- Section 1 covers theoretical *components* of crop plant genetics (assembling, refreshing, and adding to your knowledge and skills in fundamental terms, principles, and processes).
- Sections 2-4 cover *relationships* in crop plant genetics (advancing your knowledge, skills and experiences in terms, principles, and processes that involve connections among the fundamental components).
- Section 5 covers practical *applications* of crop plant genetics (investigating real-world strategies for crop genetic improvement, culminating in student presentations on crops and topics of interest).

Monday lectures will involve guiding you through textbook content, with lecture slidesets including additional or refined considerations on that's week's topic, class discussions prompted by questions posed by me and you that arise before or during class, and recommendations for preparing for upcoming classes. Wednesday activities, after dealing with any lecture material spillover from the Monday, will involve experiences in the classroom with two educational genetics projects that utilize the crop of apple. These Wednesday activities will often be connected directly to previous or upcoming field trips (see below). Friday activities will involve you applying accumulating genetics principles to a crop of interest to you.

On Canvas, ungraded quizzes are provided along the way for you to identify your own strengths and weaknesses in crop plant genetics knowledge and skills and make adjustments. A list of the course's key genetics terms is provided for each course section in Modules, so that you can see the entirety of the genetics principles you are expected to be able to know and use by the end of each section. Some additional learning resources (such as websites, scientific papers, and books) will be provided for each section in Modules. A **General Discussion Board (https://wsu.instructure.com/**

courses/1733854/discussion_topics/9081395) serves to house questions, answers, and comments during the semester.

Field trips (required)

Four 4-hour Saturday field trips will be held during the semester. These excursions will focus on hands-on learning based on (a) **MyFruitTree (https://wsu.instructure.com/courses/1733854/pages/myfruittree-background-info)** , a WSU-based genotyping research project and (b) **the Palouse Wild Cider apple breeding program (https://wsu.instructure.com/courses/1733854/pages/palouse-wild-cider-apple-breeding-program-pwcabp-background-info)** , a WSU crop genetics educational platform.

Thematic questions for these field trips will be: *Why does genetic identity matter? Why do genetic relationships matter? Why does genetic diversity matter?*

Field trips will be to WSU's Horticulture Center and to one or more historical orchards or collections in the Whitman and Latah county region. Transport to sites will be facilitated.

Pizza, apples, and water will be provided.

No required fees.

Note that participation in these sessions corresponds to equivalent less time expected for outside-of-class time spent on other course components during the semester.

Expectations of Student Effort

You are expected to prepare for each class by reading specific textbook pages, perusing the lecture slideset, and accessing and considering other learning resources provided. Make notes for yourself as you read or view. Answer questions posed. Bring notes and answers to class so you are prepared to engage in class. Often contribute **General Discussion Board (https://wsu.instructure.com/courses/1733854/discussion_topics/9081395)** posts of your questions and thoughts. Prepare for Wednesday and Friday classes following the recommendations provided at the end of each Monday class.

Each week, you are expected to invest at least 6 hours outside of class time (such as in preparation for the next class, completing assignments, taking advantage of additional learning resources provided, and working on Semester Project components), and studying for exams. This minimum time investment is expected to be needed to sufficiently engage with the course's content. Unfortunately, any less will likely leave you with a shallow understanding of the principles and consequences of genetics for crop plants and retention of any misconceptions about this discipline that you entered the course with. But if you do invest sufficiently, this field of science will surely come alive for you!

Actively participate, such as by asking questions, attempting to answer questions, making comments, joining discussions, taking turns to represent small group outcomes, looking up points of interest in real time, and enthusiastic being involved in activities.

Constantly reflect on what you are learning. Often review the content of each lecture to help clarify, such as by re-reading the textbook pages after Monday lecture (often you'll find the content then makes even more sense), reviewing the lecture slideset or watching the class recording, attending office hours or making an appointment with me, and posting questions and thoughts in the **General Discussion Board (https://wsu.instructure.com/courses/1733854/discussion_topics/9081395)** .

Complete your assessment by due dates, which will be aided by starting all assignments well before due dates and seek any clarification before it's time to submit. Don't be shy to ask for help!

As inspiration takes you, conduct deeper research into your crop and topics of interest (and you'll be able to use at least some if what you discover for components of the Semester Project).

Take advantage of **Extra Credit Opportunities (https://wsu.instructure.com/courses/1733854/modules/3124838)** .

Lean into what you bring to the course: your own interests, background, experiences, career goals, curiosity, knowledge, and questions arising during your learning in this course and others. Use these to fuel your participation during class periods, to flavor your discussion posts between classes, and as the theme for your assignments. All of us benefit from experiencing diverse perspectives and voices. Bring it on!

Expectations of Instructor Effort

You can expect me to provide for you an engaging learning environment that instills in you an excitement for crop plant genetics (if you don't already have it) and for genetics in general! Guided by my teaching motto of "maximize learning", you can expect me to: provide a clear organizational structure to the course content, guide you through and value-add to the textbook content, provide relevance and meaning to you, provide many opportunities to explore your own interests regarding specific crops and genetics topics, provide hands-on and other non-lecture activities (during and outside class time) to experience crop plant genetics principles in action, provide diverse learning resources, provide varied assessment opportunities for you to demonstrate learning and to succeed in this course, provide timely feedback, consider requests for regrading submissions, be available through the semester whenever you need me, be considerate and accommodating to issues outside your control to help ensure they don't hinder your success in this course*, and treat you with respect throughout.

* *Challenges inevitably come up! If you experience any barriers to learning (e.g., in accessing*

facilities; attending classes; keeping up with assignments; prepping for exams such as in wondering what material will be examined or how the questions will be asked; or keeping up with textbook reading, perusing slidesets, and following up on additional learning resources), please let me know and we'll adjust.

Course Timeline

See Course Schedule main menu item

Assessment

400 points total, composed of:

75 pts: Genetics of Your Crop of Interest (Friday Activities 50 pts, Presentation 25 pts) – SLOs 1–3

50 pts: Wednesdays Activities (during Sections 1-5) – SLOs 1–3

75 pts: Field Trips – SLOs 2–3

50 pts: First Exam (covers Sections 1-2) – SLO 1

50 pts: Second Exam (covers Sections 3-4) – SLO 1

100 pts: Final Exam (comprehensively covers Sections 1-5 including Field Trips and Wed & Fri Activities)

Up to +20 pts: Extra credit opportunities are available as further hands-on experiences – SLOs 1–3.

Assignments

Genetics of Your Crop of Interest (semester-long, SLOs 1-3) – **75 pts**

10 Information Sheets (5 pts each), due most Fridays (Weeks 1–10) by end of class.

1 Presentation (25 pts), conducted in Week 15 on Dec 2/4.

Overview: Each week you will relate the principles being learned in Monday and Wednesday classes to a crop of interest (your choice), for the first 10 weeks of the semester. As the weeks progress, you will build up a detailed understanding of the genetic features and improvement opportunities for your chosen crop. Then, in the last week of classes, you will give a short presentation on a chosen aspect of the genetics of your crop of interest.

Homework during each week: By the end of each Monday at the latest, you will be provided that week's Information Sheet. These sheets have a series of questions about genetic features and considerations of your crop of interest for you to answer (in the spaces provided on the sheet). You are expected to complete as much as you can of these sheets before Friday so that you are ready to discuss your findings during Friday's class. Filling in an Information Sheet during the week will involve seeking published scientific knowledge about your crop of interest, extracting specific information, making calculations, and reflecting on meaning. Often it will be helpful to review that week's textbook pages and lecture material to be sure you understand the genetics principles under investigation. Getting ahead on your Information Sheet in this way prior to class will ensure you get the most out of Friday Activities and will also help prepare you for the Presentation and exams.

Friday Activities: Friday classes of Weeks 1–10 will involve finalizing that week's Information Sheet including discussions (as a whole class and in small groups or pairs) based on your drafted answers. Relating answers for your crop of interest to other crops mentioned in the class will expand your understanding of genetics principles. You can adjust or add answers in your Information Sheet during class, and then you will submit that day.

Note that all Friday Activities, like all course components, will be assessable in the Final Exam. Your own filled Information Sheets will be allowed to be brought into any exam.

Presentations: You will choose a genetics aspect of your crop of interest and explore it in greater detail than covered in any Information Sheet. Before getting too deep, check first with Dr. Peace that you've identified a suitable focus. In class on either Dec 2 or Dec 4, each student will give a 6-8 min presentation to the rest of the class. You are expected to use PowerPoint or similar software to support the delivery of your message, such as via a series of slides. The specific order and format of your presentation is up to you. Following your presentation, there will be 3-5 min of questions from the class for you to answer.

Your presentation will be graded on:

- adherence to the discipline of genetics and to your crop of interest (3 pts)
- depth explored (7 pts)
- quantity of relevant scientific information sources considered and integrated (6 pts)
- own critical reflection integrated (6 pts)
- effectiveness of answering class questions (3 pts)
- keeping to time (-2 pts per min over or under)

Note that all Presentations (including those of other students), like all course components, will be assessable in the Final Exam.

Wednesday Activities (during Sections 1-5, SLOs 1–3) – **50 pts**

12 Activity Sheets (5 pts each, best 10 scores kept).

Due most Wednesdays (all except Weeks 3, 6, 11) by end of class.

Activities on most Wednesdays - involving observations, calculations, discussions, investigation of experimental results, and quizzes - will be based on principles covered in Monday lectures. Most activities will be associated with two ongoing WSU projects involving the important WA crop of apple: “MyFruitTree” and the “Palouse Wild Cider apple breeding program”. Work will often be in pairs and small groups, encouraging peer review of learning. During these Wednesday classes, you will fill out the provided Activity Sheets and submit that day.

Note that all Wednesday Activities, like all course components, will be assessable in the Final Exam. Your own filled Activity Sheets will be allowed to be brought into any exam.

Field Trips (throughout semester, SLOs 1-3) – **75 pts**

4 Field Trips (25 pts each, max. 75 pts with up to +5 extra credit pts).

Due on the Saturdays of each Field Trip.

At the start of each field trip, you will be given a 25-pt worksheet to submit at the end of the trip. You can score only a maximum of 75 pts, which could be achieved by a perfect score for three field trips. However, when you attend all four field trips and submit their worksheets, if the total adds to 75 pts, you will achieve the full 75 pts. And if over 75 pts you will gain up to +5 pts extra credit (toward the Extra Credit Opportunities total of +20 max.). If you miss a field trip, you will receive zero points for it and be expected to find out from the instructor and other students what was done and learned prior to the following Wednesday class.

Note that all Field Trips, like all course components, will be assessable in the Final Exam. Your own filled Field Trip worksheets will be allowed to be brought into any exam.

First Exam (in Week 6, SLO 1) – **50 pts**

A 50-min restricted-resource exam, conducted in class on Wed 25 Sep.

Covers lecture/textbook material from Sections 1–2 (Weeks 1–6). Practice exam questions will be provided each week. Resources allowed in First Exam: the course textbook and your own printed Activity Sheets, Information Sheets, and Field Trip worksheets to date.

Second Exam (in Week 11, SLO 1) – **50 pts**

A 50-min restricted-resource exam, conducted in class on Wed 30 Oct.

Covers lecture/textbook material from Sections 3–4 (Weeks 7–11). Practice exam questions will be provided each week. Resources allowed in Second Exam: the course textbook and your own printed Activity Sheets, Information Sheets, and Field Trip worksheets to date.

Final Exam (in Exam Week, SLOs 1–3) – **100 pts**

A 2-hour restricted-resource exam, conducted Mon 9 Dec at 1:30–3:30 pm.

Covers entire course, including Wednesday activities, Friday activities, Field Trips, lecture/ textbook material from Sections 1–5; including addressing common genetics misconceptions and a reflection on crop plant genetics in the context of your future professional career. Practice exam questions will be provided. Resources allowed in Final Exam: the course textbook and your own printed Activity Sheets, Information Sheets, and Field Trip worksheets.

Grading Policy

Final grades will be based on proportion of the course's 400 points earned:

		A	93-100%	A-	90-92%
B+	87-89%	B	83-86%	B-	80-82%
C+	77-79%	C	73-76%	C-	70-72%
D+	67-69%	D	63-66%	F	<63%

Attendance Policy

Attendance will not be graded, but it sure is in your best interests to be there for each class! Mondays are a great time to ask questions as we move through the material. Wednesday classes involve activities with in-class assignments to be submitted at the same time, and participation in activities on Wednesday and Fridays will help ensure you are keeping up with the course material.

But when you just can't make it… 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 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 before the event.

Late Assignment Policy

Unless a legitimate reason (see Attendance Policy above) is provided in advance, 25% will be subtracted from the grade for an assignment if submitted after the due time (most assignments are end of class, 1:00 pm) but before the next class, and another 10% per day thereafter.

Missed Exam Policy

Exams cannot be made up if missed unless a legitimate reason (see Attendance Policy above) is provided in advance.

Use of AI Policy

For assignments, use of generative AI tools (such as ChatGPT, Grammarly, DALL-E, Midjourney) for text or images is permitted in this course only with prior permission and with acknowledgment. If used, remember that it is a support tool and NOT a replacement for original effort. Consider the output of an AI tool to be just a draft or suggestion, and make sure you are subsequently the final editor. You are recommended not to rely on AI edits, as AI can readily make factual mistakes as well as logical mistakes by twisting the meaning of sourced information. And plagiarism and privacy risks exist in its use.

If you are thinking that generative AI could help with an assignment, follow these steps:

1. Check with me via email (i.e., in writing) to obtain prior permission – this will help avoid situations where its use is inappropriate.
2. Then if you do use AI to generate or edit text or images towards the final submitted product of an assignment, disclose its use: Include a statement near the start of the submitted work that discloses the platform(s) and the way it was used (e.g., “AI (program: XYZ) was used to seek suitable scientific literature / summarize sourced information / generate the initial ideas / draft the text / edit my text for improved style”). If it is an image, attribute the AI program as the source of the image, just as you would for any image used that was generated by someone else.

AI tools are not permitted for exams.

Academic Integrity Statement

You are responsible for reading WSU’s **Academic Integrity Policy (https://communitystandards.wsu.edu/policies-and-reporting/academic-integrity-policy/)**, which is based on **Washington State law (https://apps.leg.wa.gov/wac/default.aspx?cite=504-26-202)**. If you cheat in your work in this class you will:

- Fail the course.
- Be reported to the **Center for Community Standards (https://communitystandards.wsu.edu/)** .
- Have the right to appeal my decision.
- Not be able to drop the course or withdraw from the course until the **appeals** process is finished.

If you have any questions about what you can and cannot do in this course, ask me.

If you want to ask for a change in my decision about academic integrity, use **the form (https://cm.maxient.com/reportingform.php?WashingtonStateUniv&layout_id=10)** at the **Center for Community Standards (https://communitystandards.wsu.edu/)** website. You must submit this request within 21 calendar days of the decision.

University Syllabus

Students are responsible for reading and understanding all university-wide policies and resources pertaining to all courses (for instance: accommodations, crisis resources, policies on discrimination or harassment), which can be found in the university syllabus:

https://syllabus.wsu.edu/university-syllabus (https://syllabus.wsu.edu/university-syllabus)