

## COURSE OUTLINE

### **PI P 300: Diseases of Fruit Crops (Through AMS)**

**Instructor:** Naidu Rayapati, Associate Professor (Virology), Department of Plant Pathology, Washington State University (WSU), Irrigated Agriculture Research and Extension Center, 24106 N. Bunn Road, Prosser, WA 99350.

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**Number of Credits** = 2; **Pre-requisites** = BIOLOGY 120, HORT 310, or HORT 313.

**Lecture Schedule:** Fall 2016, Tuesday and Thursday between 9:10 to 10:00AM

**Origination:** Prosser IAREC; **Destination:** Pullman and Tri-Cities Campus

**Room location:** Pullman - Clark Hall 149; Tri-Cities - Wine Science Center 202; IAREC – Rose Garden Room #1.

**Guest lectures:** Where ever feasible, faculty in the Departments of Plant Pathology, Horticulture and allied disciplines will give guest lectures.

#### **Course Schedule:**

<b>Week</b>	<b>Date</b>	<b>Lecture Topic<sup>&amp;</sup></b>
<b>I. Introduction to fruit crops and their importance</b>		
1	Tuesday (8/23/16)	Introduction to the course
	Thursday (8/25/16)	Significance of fruit industry in Washington State An overview of plant pathogens
<b>II. Diseases of fruit crops caused by graft-transmissible agents</b>		
2	Tuesday (8/30/16)	Nature and biology of plant viruses
	Thursday (9/1/16)	Diagnosis and spread of viruses
3	Tuesday (9/6/16)	Management of virus diseases
	Thursday (9/8/16)	Viroids
4	Tuesday (9/13/16)	Virus diseases of grapevines
	Thursday (9/15/16)	Grapevine leafroll disease and its management
5	Tuesday (9/20/16)	Virus diseases of fruit trees
	Thursday (9/22/16)	Virus diseases of small fruits
6	Tuesday (9/27/16)	<b>Exam 1*</b>
	Thursday (9/29/16)	Disorders mimicking viral diseases of the grapevine
<b>Friday-Sunday (9/30 to 10/1/16): Field visits to IAREC, Prosser</b>		
7	Tuesday (10/4/16)	Nature, biology and diagnosis of prokaryotes (bacteria and phytoplasmas)
	Thursday (10/6/16)	Fire blight
8	Tuesday (10/11/16)	Pierce's disease
	Thursday (10/13/16)	Crown gall
<b>III. Plant parasitic nematode problems in fruit crops</b>		
9	Tuesday (10/18/16)	An over view of plant parasitic nematodes and their management

	Thursday (10/20/16)	<b>Exam 2*</b>
<b>IV. Diseases of fruit crops caused by fungi</b>		
10	Tuesday (10/25/16)	Nature and biology of fungi
	Thursday (10/27/16)	Epidemiology of fungal diseases
11.	Tuesday (11/1/16)	Fungal diseases of grapevines
	Thursday (11/3/16)	Fungal diseases of fruit trees
12.	Tuesday (11/8/16)	Fungal diseases of berry crops
	Thursday (11/10/16)	An overview of post-harvest diseases
13.	Tuesday (11/15/16)	Management of fungal diseases in grapevines (Case study: Powdery mildews in grapes)
	Thursday (11/17/16)	<b>Exam – 3*</b>
<b>November 21-25: Thanksgiving Holiday</b>		
14.	Tuesday (11/29/16)	Management of fungal diseases (Case study: Powdery mildews in fruit trees)
<b>V. Crop improvement strategies against diseases</b>		
	Thursday (12/1/16)	Traditional and molecular approaches, and challenges in perennial crops
15.	Tuesday (12/6/16)	Virus indexing and certification programs
	Thursday (12/8/16)	Course wrap up
16	Monday–Friday (12/12-16/16)	Finals week, <b>Exam – 4*</b>

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&Order of some lecture topics might change during the course.

\*Dates for Exam 1, 2, and 3 are subject to change with advance notice. Date and time for Exam 4 during finals week will be notified later.

**Method of course delivery:** Lectures & discussions are videostreamed live via AMS. The videostreamed classes through AMS are usually recorded and the videos are generally posted to Streamed Classes site at <http://www.ams.wsu.edu/Videostreaming/ClassList.aspx>. Only students enrolled in the class will have access to these archived videos. Archiving may take approximately 24-48 business hours after the daily class ends and the videos remain on the site until the end of the semester. It should be noted that archiving these videostreams are not guaranteed and are only a courtesy of AMS. **These archived videos cannot substitute class attendance and, therefore, are not intended to be used as a primary way to access classes.**

**Specific learning outcomes of the course:**

Class lectures, field visits and associated field trip reports, and discussions in the class and with growers during field visits will contribute to student learning outcomes listed below:

- Acquire scientific knowledge about diseases and disorders in fruit crops.
- Gain familiarity with regard to field- and lab-based approaches for the diagnosis of diseases and pathogens in fruit crops.
- Become familiar with different modes of spread of pathogens in fruit crops.
- Ability to apply knowledge gained from the course to manage diseases in fruit crops.
- Gain awareness of negative impacts of diseases on agricultural production and quality of produce in fruit crops.

### **Instructor-specific Expectations:**

- Attend classes regularly, ask questions, participate actively in class-room discussions.
- Participate in field trip without fail, interact with growers and other stakeholders.
- No cell phones, text messaging, internet browsing during the class, submit field trip report on or before the deadline, no late arrivals to class.
- Gain familiarity with campus safety procedures as outlined in the syllabus and follow these procedures as appropriate.
- Freshman and sophomores can use the field trip report for Writing Portfolios submissions.

### **Field Trip: Between September 30<sup>th</sup> and October 1<sup>st</sup>, 2016**

The field trip is an important learning experience and provides a unique opportunity for students to understand the ‘real world’ disease problems in fruit crops caused by different pathogens. Therefore, a field trip is mandatory for the class. A 2-day field trip to IAREC, Prosser, will be offered between September 30<sup>th</sup> and October 1<sup>st</sup>. The field trip will focus largely on diseases of grapes, apples and cherries (other tree fruits and small fruits, if available) with visits to ‘Clean’ plant programs and research farms at WSU-IAREC, Prosser, a Certified Nursery near Benton City, and grower vineyards and wineries around Prosser, and group discussions with growers and wine makers (a schedule of the field trip will be provided by September 25<sup>th</sup>). All students have to submit a field trip report describing their learning experiences within fifteen days after the field visit. Transportation will be provided, subject to availability of funds, to students in Pullman. Students from Tri-Cities and other locations are encouraged to carpool. Field trip travel guidelines as outlined in the university’s BPPM 95-13, *Student Travel*, (<http://public.wsu.edu/~forms/PDF/BPPM/95-13.pdf>) will be followed in arranging the field trip to IAREC, Prosser. Reasonable accommodation for overnight stay, if available, will be provided to students from Pullman either in the dormitories at IAREC, Prosser, or at an alternative location. Students are expected to share accommodation. Charges for accommodation will be met by other sources of funds. However, students are responsible for their own meals during the field trip. No excuses will be acceptable for missing the class and the field trip, EXCEPT a valid medical or family emergency. However, a valid proof from a competent authority acceptable to CAHNRS should be submitted to justify absence from the class field trip. Failure to participate in the field trip with no valid reason will automatically reduce the grade by one level, i.e. a ‘A’ will become a ‘B’.

### **Guidelines for Writing Field Report:**

- Each student should prepare a THREE page report (1 inch margin on all sides) with name of the student and WSU Student ID # on page 1, top right corner. The report should be typed in Word (font size 12, Times New Roman), single-spaced and proofread for grammar and spelling.
- The report should consist of a Title followed by the main report. The report should be divided into three sections: Introduction, Description of Field Visit and Summary.
- Title should be concise capturing the essence of the report.
- Introduction (one paragraph, maximum 150 words) should provide a brief background with specific objectives of the field trip.

- Main body of the field trip should be divided into sub-sections. The first sub-section will provide details about various fields visited, types of fruit crops observed and cultivar names, if available. The second sub-section will provide a list of different diseases observed, description of symptoms of diseases and type of pathogen associated with each disease. Scientific names of different pathogens and hosts will be listed in italics. A brief description of nutritional disorders in grapes and how they differ from viral diseases will be included. The third sub-section will provide a brief summary of visits to WSU-IAREC and grower fields, discussions with growers and wine makers to learn impacts of diseases on quality attributes of fruits and management tactics used for different diseases, with emphasis on fungal, bacterial and viral diseases.
- The summary section (one paragraph of up to 150 words) should provide learning experiences gained by each student from the field trip and how these experiences are helpful in management of diseases in fruit crops.
- At the end of the field trip, students will evaluate the effectiveness of the field trip. A structured questionnaire will be provided to students to gauge the effectiveness of the field trip and solicit suggestions for improvements of future field trips.

### **Grading of Field Trip Report:**

The field trip report and evaluation report combined carries 100 points. They will be graded based on student participation in the field trip and quality and timely submission of the report describing the experiences and knowledge gained and the evaluation report. Misspelling of scientific names of fruit crops and pathogens will cost points.

### **Grading Rubric:**

Participation in the field trip	40
Report in Word format as per the guidelines (Font size [12, New Times Roman], margins, line spacing, #words in introduction and summary sections and page limit)	5
Spellings, grammar and proper scientific names	5
Scientific content and quality of the report	30
Logical conclusions in summary section	10
Timely submission	5
Completing the questionnaire	5
<b>Total points</b>	<b>100</b>

### **Overall Course Grading:**

For the lecture portion, there are four exams, each carry 100 points. No final comprehensive exam. The exams will take largely the form of fill-in-the-blank and multiple choice, and a few short answer questions. The short answer questions will be “thought-provoking” and are designed to require application of information presented in class to real-world situations. The exam(s) will also be supplemented, if required, with assignments/Quizzes at the discretion of the instructor. Misspelling of scientific names of fruit crops and pathogens will cost points. Field visit described above will carry 100 points. It will be graded based on student participation in

the field trip and quality and timely submission of the report describing the experiences and knowledge gained. Thus, lecture portion carry 80% (400 points) and field visit carry 20% (100 points) of total grades.

Exams will be conducted similar to courses offered through AMS as per WSU policies (Academic Regulations 77, 78, and 79). Question paper will be delivered to the students in the class by the lead instructor or through designated person(s) who will proctor the exam. In the latter case, the answer papers will be collected by the designated person(s) and delivered to the lead instructor for grading. Students will be monitored during the exam by the instructor and/or the person(s) proctoring the exam. Make-up exam (only for Exam 1, 2 or 3, but NOT final exam 4) will be allowed ONLY under a valid medical or family emergency. Note that “no early examination will be conducted for the purpose of leaving the institution before the close of the semester (Academic Regulation 79).”

**Grading Scale:**

A = 95 – 100%

A<sup>-</sup> = 90 – 94%

B<sup>+</sup> = 86 – 89%

B = 82 – 85%

B<sup>-</sup> = 80 – 81%

C<sup>+</sup> = 76 – 79%

C = 72 – 75%

C<sup>-</sup> = 70 – 71%

D<sup>+</sup> = 66 – 69

D = 60 – 65%

F = Below 60%

**Class Attendance:**

Class attendance is very important. Missing even one class will put students out of synch with the course leading to poor performance in the exams. Students are encouraged to ask questions during the lecture or outside the class time. Due to physical location of the instructor, arrangements will be made by appointment to answer questions (via telephone, e-mail and/or face-to-face meeting), if students would like assistance with class materials.

Class attendance will be taken daily to document presence of students in the class. Excused absence is considered because of “illness, personal crises, mandated court appearances, parental responsibilities, and the like.” These absences are considered and accepted on a case by case as long as they are not excessive and provide a written explanation of the absence. In the case of a student attending an off-campus university-sponsored activities, a properly signed Class Absence Request form should be submitted to the instructor at least one week in advance of the event. In addition, “reasonable accommodation can be provided in regards to religious holidays as spelled by Academic Regulation 82”. Contact the instructor for necessary approvals as per Academic Regulation 73.

**Student Evaluations:**

Students will be encouraged to participate in on-line evaluations. In order to increase response rate, a minor incentive of 10 points (10 points of total 500 points, which is 2%) will be added at the end of semester final grade to those students who have completed evaluations on time.

**WSU Reasonable Accommodation Statement:**

Reasonable accommodations are available for students with a documented disability (<http://www.accesscenter.wsu.edu>). If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (formerly the Disability Resource Center [DRC]) at 509-335-3417. All accommodations MUST be approved through the Access Center (Washington Building 217; 509-335-3417). You will need to provide your instructor with the appropriate classroom accommodation form. The form should be completed and submitted during the first week of class. Late notification can delay your accommodations or cause them to be unavailable. All accommodations for disabilities must be approved through the Disability Services Coordinator.

For students at Pullman campus and R&E Centers: Stop by or call 509-335-3417 to make an appointment with a disability specialist (<http://www.accesscenter.wsu.edu>, [access.center@wsu.edu](mailto:access.center@wsu.edu)). For students at Tri-Cities campus: If you have a documented disability, even temporary, make an appointment as soon as possible with the Disability Services Coordinator, Cherish Tijerina, Room 269D West Building; Phone:509-358-7534. (<http://www.tricity.wsu.edu/disability/>).

**Academic Integrity:**

“Academic integrity is the cornerstone of the university. Any student who attempts to gain an unfair advantage over other students by cheating, will fail the assignment and be reported to the Office Student Standards and Accountability. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3).” All students enrolled in the class are expected to remember and practice Academic Honesty in fulfilling all of the course requirements as outlined in the syllabus. Please use these resources to ensure that you don’t inadvertently violate WSU’s standard of conduct. “Students are expected to read the Washington State University Policy on Student Standards and Accountability (<https://conduct.wsu.edu/>). Students are free to contact the Office of Student Standards and Accountability (509-335-4532) for specific information about this process.

**Policy Prohibiting Discrimination and Sexual Harassment:**

WSU is committed to maintaining an environment free from discrimination, including sexual harassment. This policy applies to all students and faculty instructor(s) of this class.

**Safety and emergency management:**

Washington State University is committed to maintaining a safe and secure environment for students, faculty, staff, and visitors on all campuses. 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 to). 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](#).

The university has developed a Campus Safety Plan (<http://safetyplan.wsu.edu/>) and WSU ALERT (<http://alert.wsu.edu>). We encourage you to become familiar with the Campus Safety Plan and visit the Office of Emergency Management web site (<http://oem.wsu.edu/>) for a comprehensive listing of university policies, procedures, statistics, and information related to campus safety, emergency management, and the health and welfare of the campus community. WSU continues to improve emergency management strategies and takes a broad range of proactive measures aimed at safety and well-being of its members in these campuses. Visit the Office of Emergency Management (<http://oem.wsu.edu/emergencies>) and WSU ALERT site (<http://alert.wsu.edu/>) for detailed information about campus safety and security, and relevant notification during emergencies. You can sign up for emergency alerts at <http://alert.wsu.edu> through the MyWSU site (<http://my.wsu.edu>). Please go to the myWSU portal at <http://my.wsu.edu> and register your emergency contact information for the Crisis Communication System (CCS) and the Campus Outdoor Warning System (COWS). Enter your network ID and password and you will be taken to the myWSU main webpage. Look for the Emergency Notification box on the right side of the page and click on Register to be taken to the registration page where you can enter your cell, landline, and email contact information.

For students at Tri-Cities campus, a more comprehensive explanation of the campus safety plan is available at <http://www.tricity.wsu.edu/safetyplan/>. Should there be a need to evacuate the building (e.g. fire alarm or some other critical event), students should meet the instructor at the entrance outside of the Wince Science Center building.

Please visit the websites <http://safetyplan.wsu.edu> and <http://oem.wsu.edu/Emergencies> for the Campus Safety Plan and University emergency management plan, respectively, for a comprehensive listing of university policies, procedures, statistics, and information relating to campus safety, emergency management, and the health and welfare of the campus community.

**The Writing Center:** The WSU Writing Program offers free tutorial services to all undergraduate, graduate and professional students. Here, tutors can help you with various writing issues you may encounter. The WSU Pullman Writing Center is located in CUE-303 (509-335-7959) and WSU Tri-Cities Writing Center is located on the 2<sup>nd</sup> floor of the CIC library (509-372-7342). Walk-ins are welcome. Specially trained peer tutors can assist students to develop strong writing skills.

### **Recommended Text Books:**

No specific textbook is assigned for the course, since a few text books exclusively cover diseases of fruit crops. The following general plant pathology text books, compendia of specific fruit

crop diseases, and current information from the primary literature (journal and review articles and web sites) are recommended as resources for the course.

**Essential Plant Pathology** 2<sup>nd</sup> Edition. 2010. APS Press, St. Paul. 369 pp. Authors: Gail L. Schumann and Cleora J. D'Arcy

**Plant Pathology** 5<sup>th</sup> Edition. 2005. Academic Press, New York. 922 pp. Author: George N. Agrios

## References for additional reading:

### I. Crop-specific books/compendia:

**Grape Pest Management.** Second Edition. 1992. University of California-Davis.

**Graft-transmissible diseases of grapevines.** 1993. Edited by G.P. Martelli. FAO, Rome.

**Compendium of Grape Diseases.** 2015. Edited by Wayne F. Wilcox, Walter D. Gubler, and Jerry K. Uyemoto. American Phytopathological Society press, St. Paul.

**Compendium of Apple and Pear Diseases and Pests.** 2014. Edited by Turner B. Sutton, Herb S. Aldwinckle, Arthur M. Agnello, and James F. Walgenbach. American Phytopathological Society Press, St. Paul.

**Compendium of Strawberry Diseases.** 1998. Edited by J.L. Maas. American Phytopathological Society Press, St. Paul.

**Compendium of Blueberry, Cranberry, and Lingonberry Diseases and Pests. 2016.** Edited by James J. Polashock, Frank L. Caruso, Anne L. Averill, and Annemiek C. Schilder. American Phytopathological Society Press, St. Paul.

**Integrated Pest Management for Stone Fruits.** 1999. UC IPM Publication No. 3389. University of California, Davis.

**Compendium of Stone Fruit Diseases.** 1995. Edited by J.M. Ogawa, E.I.Zehr, G.W. Bird, D.F. Ritchie, K. Uriu, and J.K. Uyemoto. American Phytopathological Society Press, St. Paul.

**Virus/Virus-like Diseases of Pome Fruits, Simulated Noninfectious Disorders.** Edited by Paul Fridlund. Washington State Extension Bulletin No. SP0003. 1989.

**Virus Diseases of Small Fruits.** USDA ARS Agriculture Handbook No. 631. Edited by R.H. Converse. 1987. 277 pp.

**Virus and Virus-Like Diseases of Pome and Stone Fruits.** 2011. Edited by Ahmed Hadidi, Marina Barba, Thierry Candresse, and Wilhelm Jelkmann. American Phytopathological Society Press, St. Paul. 428pp.

**Manual of Agricultural Nematology.** Nickle, W.R. 1991. Marcel Dekker, Inc. New York.

**Postharvest Diseases of Fruits and Vegetables – Development and Control.** Barkai-Golan, R. 2001. Elsevier Science B.V. 418pp.

**Post Harvest Technology of Horticultural Crops.** Kader, A. A. 2002. University of California Agricultural and Natural Resources Publication 3311. 535pp.

### II. Supplemental references:

1. **Famine on the Wind: Man's Battle Against Plant Disease.** 1967. Rand McNally & Co., 231 pp. Authors: G.L. Carefoot and E.R. Sprott.



2. **Plant Diseases: Their Biology and Social Impact.** 1991. APS Press, St. Paul. 397 pp.  
Author: G.L. Schumann.
3. **History of fruit growing and handling in United States of America and Canada 1860-1972.** 1976. Regatta City Press Ltd. 360 pp. Edited by: D.V. Fisher and W.H. Upshall.
4. **Plant Disease: A Threat to Global Food Security.** Annual Review of Phytopathology. Vol. 43, pages 83-116, 2005 (DOI: 10.1146/annurev.phyto.43.113004.133839). Review article written by Richard N. Strange and Peter R. Scott.
5. **Pandemics aren't just for people: how disease can affect crops and the food supply.** Journal of the American Dietetic Association. Vol 110, pages 18-24 (doi: 10.1016/j.jada.2009.11.002). Article written by B. Boyce.

### III. Web sites:

<http://wine.wsu.edu/virology/>

<http://americanpomological.org/>

<http://plant-disease.ippc.orst.edu/index.cfm>

<http://www.agf.gov.bc.ca/cropprot/tfipm/treefruitipm.htm>

<http://www.caf.wvu.edu/kearneysville/wvufarm11.html>