HRT 351L - Hydroponic Food Production Lab (2 credits)

Department of Horticulture
Michigan State University
Fall Semester, 2025

Part I. Course Information

Instructor
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Lab Location
Teaching Greenhouses C101 and C103
Tuesday and Thursdays: 1:50 PM-2:40 PM PSSB A186
Friday, 1:50 to 3:40 PM PSSB B109

Note: as is the nature of greenhouse crop production, additional hours of crop management will be required for all students including weekends. Each weekend, groups will need to conduct daily tasks needed for maintaining crops in the greenhouse.

Course Communication

As the instructor for HRT 351L, I am here to answer your questions to ensure you meet the outlined learning objectives by the completion of the course. I do not have scheduled office hours, but meeting times may be arranged by making an appointment via e-mail.

Please review the many communication options below to ensure that our interactions are efficient for all parties.

- The best way to reach me outside of class is by sending me an e-mail. Please email me at rglopez@msu.edu or through the D2L email option (both will go to the same mailbox). I will respond to whichever email you use, so be sure to check that same mailbox.
    - Allow me at least 24 hours (48 hours on the weekends) to provide a response. I will likely be checking my email more frequently, but allow this much time before projects, and exams are due.
    - I will email the class from the D2L website, which automatically goes to your D2L mailbox. If you have not already, consider adding a forwarding email address in the settings of your D2L mail to ensure you are getting all correspondence.
    - Professional email etiquette is expected. For more information on what that means, please visit the article, "The Do's and Don'ts of Email Etiquette." (https://www.entrepreneur.com/article/272780)
- Alternatively, feel free to stop by my office to see if I'm available.
- I strongly encourage you to ask questions at any time and not wait unit the day before the exam.
- Many students don't know how to address their professors or instructors. You are free to call me by my first name (Roberto), or as Dr. Lopez. You may choose whichever is most comfortable.

Course Pre- and Co-requisites

It is expected that students enrolled in this course will have successfully passed and completed HRT 203 (Principles of Horticulture) and HRT 204 (Plant Propagation) at MSU or a similar course at another location.

Students will need to be familiar with the basic concepts of greenhouse crop culture including environment (light, temperature) and culture (irrigation water, fertilizer). Students registered for this laboratory must be registered for the HRT 351 (Hydroponic Food Production concurrently in the same semester (HRT 351 and HRT 351L may not be taken in separate semesters).

Course Description

HRT 351L: Hydroponic Food Crop Production Laboratory with the concurrent lecture (HRT 351) will provide practical, hands-on, and experiential greenhouse hydroponic food crop production and management training. You will grow leafy greens (lettuce, herbs, etc.), microgreens, and fruiting crops (ie. tomatoes, cucumbers, peppers, and strawberries) in several commercially important hydroponic systems utilizing current scientific knowledge and industry best management practices.

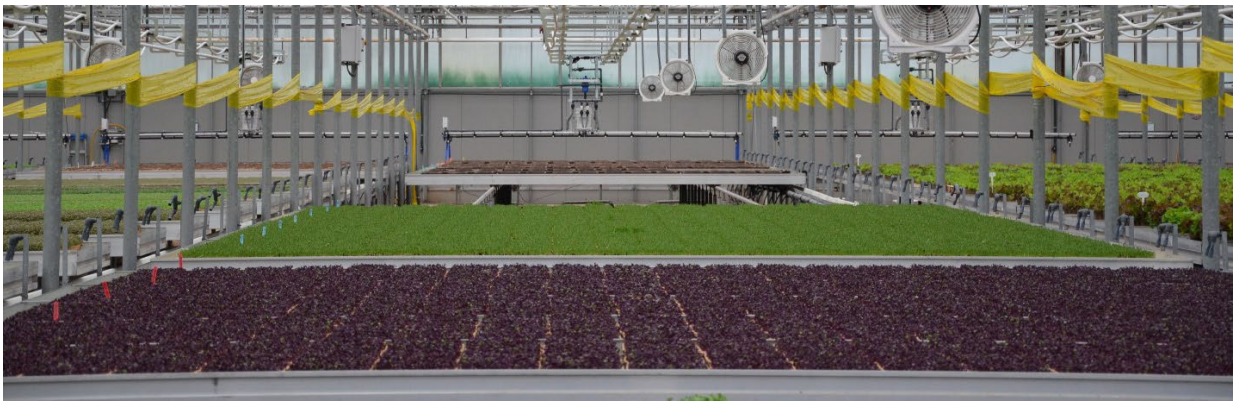
Additionally, you will gain experience with related management concepts such as monitoring and managing nutrient solutions, scouting, and identifying pests, disease, and physiological disorders, measuring environmental parameters, food safety practices. Laboratory attendance is mandatory and this will primarily be assessed through weekly online quizzes as well as participation points. You must read the lab instructions prior to coming to lab.

Course Structure

For most labs, the class will first gather in PSSB A186 on Tuesday and Thursday and B109 on Fridays for a short business meeting and then move to the greenhouse for the hands-on activities. You and your group will manage all aspects of production similar to what is done by commercial growers.

Your group will be assigned five NFT (Nutrient Film Technique) channels (lettuce) under LEDs and 5 under HPS, one DWC (deep water culture) tank under LEDs and 1 under HPS (herbs), 2 bato buckets (cucumbers) under LEDs and 2 under HPS, 2 rockwool slabs (tomatoes and peppers) under LEDs and 2 under HPS, five California strawberry substrate troughs (strawberries) under LEDs and 5 under HPS, and 4 microgreen trays which will be your responsibility to care for during the duration of the class. Weekly maintenance duties will be taught in lab and include (seeding, transplanting, harvesting, trellising, pruning, monitoring nutrient solution pH and EC).

Daily maintenance of crops outside of the scheduled lab time will be required as plants do not observe weekends or holidays. Daily crop maintenance will include: adding deionized water (DI) to tanks, logging and adjusting pH and EC; adjusting fertility, and scouting for pests or diseases. As you will be working in the greenhouse, please wear appropriate clothing (comfortable, stable, closed-toe footwear, and casual clothing).



Crop Maintenance / Participation/ Following Directions/ Community Citizen Points

Four elements will go into crop maintenance/participation/ following directions/ community citizen points, 1) your timely logging of your crop specific harvest data (pH, EC, temperature, DLI, yield, etc.) and observations (insects, diseases, etc.) on the specific One Drive files, checking on the class systems on your assigned weekends; 2) participation and contributing to class discussions; 3) following pruning, plant care, harvesting, etc. instructions and directions and 4) being a community citizen by cleaning up greenhouse and headhouse areas when tasks are completed. In addition, there will be 3 reflections, and a crop report (oral and written).

You will occasionally have the opportunity to take some produce home with you after lab (such as lettuce, herbs, strawberries, tomatoes, peppers, and cucumbers).

Part II. Lab Goals and Objectives

Course Goals

Upon completion of HRT 351L students will be able to work with a variety of hydroponic systems used in food crop production, produce a variety of food crops in hydroponic systems, and critically analyze hydroponic food production system benefits and limitations.

Lab Objectives

After completing this lab, students will be able to:

- Construct and operate different hydroponic systems used in hydroponic food crop production;
- Produce different food crops in several hydroponic systems;
- Manage crop nutrition in a hydroponic system;
- Demonstrate plant care and maintenance practices necessary to produce healthy and high-quality hydroponic crops.
- Use a spreadsheet to develop fertilizer recipes for common hydroponic crops.
- Develop skills for planning, designing, conducting and reporting hydroponics research.

Desired Learning Outcomes

- Ability to explain how hydroponic systems are designed to meet the physical, chemical, and biological needs of plant roots.
- Ability to discuss the benefits and constraints of several different hydroponic systems and hydroponically grown food crops.
- Ability to articulate the ideal growing environment and plant response to temperature, light, and carbon dioxide for several of the most common hydroponically grown crops.
- Ability to analyze environmental and crop data obtained in the greenhouse.

Part III. Lab Outline and Schedule

The lab schedule below will be adjusted weekly as plant growth and development varies from week to week. The first column contains the lab date, the second column includes the grower week, the third column has the lab topic or activity, the fourth column has information about student preparation for the class period (readings and assignments due) and the fifth column has the instructor.

Lab date	Grow. week	Lab activity	Reading or assignment	Instruct.
Aug. 26 (T)	35	Lab 1: Group greenhouse walk through; wash bato buckets & fill w/ perlite outside and saturate rockwool slabs		Lopez
Aug. 28 (Th)	35	Lab 2: transplant tomatoes and pepper		Lopez
Aug. 29 (F)	35	Lab 3: Fill strawberry troughs and transplant in the headhouse; sow lettuce and herb seeds		Lopez
Sept. 2 (T)	36	Lab 4: Crop maintenance	Quiz 1 due	Lopez
Sept. 4 (Th)	36	Lab 5: Biocontrol lecture and WPS training videos	https://www.youtube.com/watch?v=1SQ9pMy02dU https://www.youtube.com/watch?v=WK7XnWslkwQ	Cervantes
Sept. 5 (F)	36	Lab 6: Transplant cucumbers		Lopez
Sept. 9 (T)	37	Lab 7: Crop maintenance	Quiz 2 due	Lopez
Sept. 11 (Th)	37	Lab 8: Pollination and transplant lettuce seedlings		Lopez
Sept. 12 (F)	37	Lab 9:		Lopez
Sept. 16 (T)	38	Lab 10: Transplant herbs	Quiz 3 due	Lopez
Sept. 18 (Th)	38	Lab 11: Tissue analysis		Lopez
Sept. 19 (F)	38	Lab 12:		Lopez
Sept. 23 (T)	39	Lab 13: Stick cuttings	Quiz 4 due	Lopez
Sept. 25 (Th)	39	Lab 14: General lab tasks		Lopez
Sept. 26 (F)	39	Lab 15		Lopez
Sept. 30 (T)	40	Lab 16: General lab tasks	Quiz 5 due	Lopez
Oct. 2 (Th)	40	Lab 17: Sow Lettuce Seeds	Reflection 1 due	Lopez
Oct. 3 (F)	40	Lab 18:		Lopez
Oct. 7 (T)	41	Lab 19: Sow Cucumber seeds	Quiz 6 due	Lopez

Oct. 9 (Th)	41	Lab 20: Sow herb seeds		Lopez
Oct. 10 (F)	41	Lab 21:		Elbert/ Cooley
Oct. 14 (T)	42	Lab 22: Fill smart pots, harvest herbs	Quiz 7 due	Elbert/ Cooley
Oct. 16 (Th)	42	Lab 23:		Elbert/ Cooley
Oct. 17 (F)	42	Lab 24:	Quiz 8 due	Elbert/ Cooley
Oct. 21 (T)	43	Fall Break No lab		Lopez
Oct. 23 (Th)	43	Lab 25: Transplant lettuce and herbs	Quiz 9 due	Lopez
Oct. 24 (F)	43	Lab 26: Field trip to Grand Rapids		Lopez
Oct. 28 (T)	44	Lab 27: Tissue analysis	Reflection 2 due	Lopez
Oct. 30 (Th)	44	Lab 28: General lab tasks	Quiz 10 due	Lopez
Oct. 31 (F)	44	Lab 29: Brix	Fieldtrip Assign. due	Lopez
Nov. 4 (T)	45	Lab 30:		Cooley
Nov. 6 (Th)	45	Lab 31: TBD	Quiz 11 due	Elbert/ Cooley
Nov. 7 (F)	45	Lab 32:		Elbert/ Cooley
Nov. 11 (T)	46	Lab 33: TBD		Lopez
Nov. 13 (Th)	46	Lab 34: Tissue analysis	Quiz 12 due	Lopez
Nov. 14 (F)	46	Lab 35:		Lopez
Nov. 18 (T)	47	Lab 36: TBD	Submit Powerpoint via D2L	Lopez
Nov. 20 (Th)	47	Lab 37:		Lopez
Nov. 21 (F)	47	Lab 38: Crop Report Presentations		Lopez
Nov. 25 (T)	48	Lab 39: Crop Report Presentations	Quiz 13 due	Lopez
Nov. 27 (Th)	48	Thanksgiving – No Lab		
Nov. 28 (F)	48			
Dec. 2 (T)	49	Lab 40: Crop Report Presentations	Reflection 3 due	Lopez
Dec. 4 (Th)	49	Lab 41: Crop Report Presentations		Lopez
Dec. 5 (F)	48	Lab 42: Clean up greenhouses		Lopez

***The above schedule is tentative and is subject to change

Part IV. Grading Policy
Assignments and Grading

Attendance and Online Quizzes

Laboratory sessions are your opportunity to gain practical hands-on experience growing common hydroponic crops and gain experience with related management concepts such as monitoring and managing nutrient solutions, scouting for pest and disease issues, measuring light, etc. Laboratory attendance is mandatory and this will primarily be assessed through the weekly online quizzes as well as participation points.

Reflections

Three times during the semester you will be asked to provide written reflections of about 1 page in length. Reflections must be submitted electronically via D2L and must be submitted by 11:59 PM on the due date. More information on reflections will be provided. Each reflection should address these three areas: 1) reflect on a classroom learning/laboratory experience for example: how did it affect you or change your viewpoint? What would have you done differently in the future? 2) find one news article related to hydroponics/aquaponics (such as in www.hortidaily.com), briefly summarize the article and describe why it resonated with you; 3) find one job classified (such as in Hortidaily, ponicjobs.com, or etc.), summarize the position and describe why it appeals or does not appeal to you.

Greenhouse Field Trip

One 1-day field trip to visit commercial greenhouses is planned for **Friday October 24** (roughly 8 am to 5 pm). This is a mandatory field trip for this course. The objective of the trip is to see and learn firsthand about commercial hydroponic production and related industries in the supply chain. Further details forthcoming. Absence is only allowed if prearranged through the instructor. Failure to prearrange the absence in your other classes is not an allowable excuse.

Please notify your other instructors now about your absence

I will be providing a signed letter explaining the field trip to give your other instructors.

Field Trip Writing assignment

You will prepare a written report based on the stops on the 1-day field trip. For each stop you prepare about a ½ page summary including: company name, city, size, and type of operation, crops grown, growing techniques, and market(s) they sell to. In addition, identify 1 practice that you were very impressed with and 1 area that would be a room for improvement for each operation.

Grading
92-100% = 4.0
85-92% = 3.5
80-84% = 3.0
75-79% = 2.5
70-74% = 2.0
65-69% = 1.5
60-64% = 1.0
< 60% = 0

Total point breakdown for the course

Item	**Points**
Quizzes	
Quiz 1-13*	10 points each
(*Lowest 3 quiz grades dropped) **Subtotal**	**100**
Reflections	
3 reflections	25 points each
Subtotal	**75**
Field trip assignments	
Grand Rapids	100 points
Subtotal	**100**
Class Attendance and Participation	
27 labs x 10 points per lab*	2 missed labs dropped
(*2 missed labs dropped)	**250**
Crop Presentation	
Power point	50 points
Oral Presentation	100 points
Subtotal	**150**
Crop Quality Evaluations	
Subtotal	**300**
Grand total	**975**

Late Work and Make-Up Policy

All assignments are due on the assigned due date. **No late assignments will be accepted**, unless the student contacts us ahead of time AND has extenuating circumstances. Assignments **cannot** be handwritten and must be submitted via D2L. **No e-mailed assignments will be accepted.**

There will be no make-ups for missed quizzes. The lowest quiz score will be dropped. M No exceptions (ie. unless you are hospitalized).

Viewing Grades

Grades will be posted on D2L for all assignments, quizzes, and reflections. Please keep the assignments handed back to you and double-check your grades in D2L to avoid discrepancies.