The University of Manitoba

Faculty of Agricultural and Food Sciences

TABLE OF CONTENTS

COURSE DETAILS

Course Title: Physiology of Crop Plants

Department: Plant Science **Course Number:** PLNT 4590

Academic Session: Winter 2021 **Credit Hours:** 3

Prerequisites and How They Apply to This Course: BIOL 2242 - a study of the structure and function of the flowering plants. Moreover, basic knowledge in crop science and soil science is desirable.

Lecture Hours: 12:30 - 1:20 pm (MWF) **Location:** delivered remotely

Laboratory Hours: 2:30 - 5:25 pm (W) **Location:** delivered remotely

Department Office Location: 222 Agriculture Building

Course Web Page: UM Learn @ https://universityofmanitoba.desire2learn.com/d2l/login

INSTRUCTOR CONTACT INFORMATION

Instructor: Dr. Belay Ayele (I prefer to be addressed as "Belay")
Office Location: Room 111 Agriculture Building
Research Lab Location: Room 112, Crop Technology Center, 194 Dafoe Road
Office Phone Number: 204-474-8227
Email Address: belay.ayele@umanitoba.ca
Office Hours: 11:00 - 12:30 pm (Thursdays). Please email me to set appointment for a Cisco WebEx meeting. I will reply to your emails within 24 hours.

Lab Teaching Assistant: Ms. Virginia Janzen
Office Location: Room 150 Agriculture Building
Email Address: umjanzev@myumanitoba.ca
Office Hours: Please email Virginia

GENERAL COURSE INFORMATION

Why This Course is Useful?

This course is designed to help students integrate and better understand crop growth, development and yield from the perspective of whole plant physiology. In this course, students will gain an overview of crop physiological processes that are necessary to understand how plants operate, and interact with their environment. The course is useful to understand and interpret agronomic phenomena contributing to crop yield. It also offers an opportunity to survey contemporary aspects of crop physiology with emphasis on recent research progress in related fields.

Who Should Take This Course?

This course has considerable value to students in the field of agricultural science including agronomy, crop management, plant breeding and plant biotechnology. As it extensively covers theoretical and practical aspects of crop physiological processes and crop-environment interaction, the course is also of interest for students of applied ecology and environmental science.

How This Course Fits into The Curriculum?
Crop physiology is an integrative course that builds on and applies the conceptual and technical information presented in the foundation courses from a variety of disciplines including plant physiology, crop production, soil science, botany and ecology to further enhance students' capabilities to bear on problems of yield improvement and crop management, and undertake graduate studies in preparation for advanced research and teaching positions.

COURSE GOALS

***Undergraduate Calendar Description*:** Concepts dealing with the physiological response of crop plants to the environment from the time of seed germination through to reproduction.

***Instructional Methods*:** This course will consist of lectures (with the aid of PowerPoint presentations) and obligatory laboratory work. The lectures are designed to orient students with the conceptual information in the text and current topics in the subject. Copies of the course outline and PowerPoint slides of lectures will be posted under course content on the course's UM Learn site ahead of time. The laboratory part of the course will provide opportunities in structured labs and independent investigations.

Both the lectures and labs of the course are delivered remotely using a synchronous course design. Your computer/device and internet connection must meet the UM minimum requirements found here https://centre.cc.umanitoba.ca/wp-content/uploads/2020/04/Student-Connectivity-Recommendations.pdf. This course requires additional specialized software: WebEx. Students can access events scheduled by the instructor via accessing Cisco WebEx on this course's website on UM Learn.

***Course Goals*:** The aim of this course is to give students a greater understanding of the physiological processes, plant responses and environmental factors affecting growth and productivity of the agricultural crops we depend on, and to stimulate students' learning of basic concepts in crop growth and development. The course is also designed to enable students to use the knowledge of crop physiology to answer practical questions. Basic concepts underlying crop physiology will be demonstrated through laboratory exercises. Specific objectives of this course are the following:

1. Describe in detail the physiology and biochemistry of crop seed germination and dormancy;
2. Examine the physiological aspects of crop growth and phenological development;
3. Define and analyze the mechanisms by which crop plants acquire and utilize resources like carbon, water, light and mineral nutrients;
4. Discuss the concepts of assimilate translocation and dry matter partitioning in a crop plant;
5. Examine the physiology of crop adaptation to their environment;
6. Review the physiological basis for crop production and management practices; and
7. Develop critical thinking and problem solving skills with respect to crop physiology.

INTENDED LEARNING OUTCOMES

1. Distinguish key physiological processes underlying the formation of seedlings from seed embryos;
2. Identify the physiological factors that regulate growth and developmental processes of crop plants, and clearly define their roles;
3. Evaluate the different strategies used by plants to acquire and utilize resources, and formulate a logical argument of their impact on crop productivity;
4. Recognize the significance of assimilate translocation and patterns of dry matter partitioning in determining crop yield;

5. Demonstrate a clear understanding of crop-environment interaction and its implication on crop growth and yield;
6. Relate crop physiological processes with agronomic practices used in crop production systems; and
7. Integrate and apply their knowledge of crop physiology for analytical thinking and solving practical problems experienced in agricultural systems.

USING COPYRIGHTED MATERIAL

Please respect copyright. We will use copyrighted content in this course. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the *Copyright Act* applies or written permission has been confirmed. For more information, see the University's Copyright Office website at http://umanitoba.ca/copyright/ or contact um_copyright@umanitoba.ca.

RECORDING CLASS LECTURES

Dr. Ayele and the University of Manitoba hold copyright over the course materials, presentations and lectures which form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission from Dr. Ayele. Course materials (both paper and digital) are for the participant's private study and research, and must not be shared. Violation of these and other Academic Integrity principles, will lead to serious disciplinary action.

Classes of the course are offered via Cisco WebEx and they will be recorded and posted on UM Learn in order to support students who may encounter problems with their technology during lectures sessions. Participation in class lectures is assumed to be consenting to such recordings.

TEXT BOOKS AND READING MATERIALS

Recommended Textbook

Taiz L and Zeiger E (2010) Plant Physiology. 5th ed. Sinauer Associates, Inc. Publishers, Sunderland, MA ISBN: 978-0-87893-866-7. It is available at the book store.

Supplementary Reading

Though the text book provides reasonable coverage for most of the topics in the course, it is not either sufficiently detailed or does not cover some of the topics to be discussed in this course. To supplement the shortfalls, please refer to selected chapters from the following books:

Bewley JD and Black M (1994) Seeds: Physiology of Development and Germination. 2nd ed. Plenum Press, New York.

Gardner FP, Pearce RB and Mitchell RL (1985) Physiology of Crop Plants. Iowa State University Press, Ames, IA, USA.

Hay R and Porter J (2006) The Physiology of Crop Yield. 2nd ed. Blackwell Publishing Ltd, Oxford, UK.

Marschner H (1995) Mineral Nutrition of Higher Plants. 2nd ed. Academic Press, San Diego, CA, USA.

These books are available through the University of Manitoba library. For services the libraries are providing during the pandemic please visit https://libguides.lib.umanitoba.ca/c.php?g=717736

Additional Materials

Supplementary reading materials will be posted on the course's UM Learn website (https://universityofmanitoba.desire2learn.com/d2l/login), and you will be notified of any updates by email from your instructor.

COURSE TECHNOLOGY

It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. The student can use all technology in the classroom setting only for educational purposes approved by the instructor and/or the University of Manitoba Disability Services. Student should not participate in personal direct electronic messaging / posting activities (e-mail, texting, video or voice chat, wikis, blogs, social networking (e.g. Facebook) online and offline "gaming" during scheduled class time. If student is on call (emergency) the student should switch his/her cell phone on vibrate mode and leave the classroom before using it. (©S Kondrashov. Used with permission).

CLASS COMMUNICATION

The University requires all students to activate an official University email account. For full details of the Electronic Communication with Students please visit: http://umanitoba.ca/admin/governance/media/Electronic_Communication_with_Students_Policy_-_2013_09_01_RF.pdf. Please note that all communication between myself and you as a student must comply with the electronic communication with student policy (http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html). You are required to obtain and use your U of M email account for all communication between yourself and the university.

EXPECTATIONS: I EXPECT YOU TO

***Attend lecture class*:** Most important course materials are discussed in the lecture, thus successful completion of this course requires that students attend all classes, and they are also expected to arrive in good time for all these meetings, participate in class discussions and take notes during the class. Missing a class will make understanding of materials presented in subsequent sessions difficult. Students should refrain from any disruptive behaviors during class time.

Attend lab: Lab attendance is mandatory. Reports will not be accepted if the lab is not attended, unless the student provides acceptable justification and/or documentation as required.

Participate: It is essential that students actively engage in class discussions (e.g. actively listening, posing and responding to questions) and group efforts. Your class participation will be critical for favourable consideration in the case of a borderline grading situation.

Respect: I will treat you with respect and would appreciate the same courtesy in return. See Respectful Work and Learning Environment Policy.

***Group Work Policies*:** Regardless of how each lab work is performed (individually or in group); lab reports should be written on an individual basis.

***Use of Third Party Detection and Submission Tools*:** Electronic detection tools may be used to screen assignments in cases of suspected plagiarism.

STUDENT ACCESSIBILITY SERVICES

If you are a student with a disability, please contact Student Accessibility Services (SAS) for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation.

Student Accessibility Services http://umanitoba.ca/student-supports/accessibility
520 University Centre
204 474 7423
Student_accessibility@umanitoba.ca

EXPECTATIONS: YOU CAN EXPECT ME TO

I will be in class before or on time. My teaching practice involves the use of questions in class. I expect students to respond but I do not expect perfection.

DESCRIPTION OF EXAMINATIONS

There will be two exams. The first exam will cover mainly the lectures and reading materials covered prior to the exam, whereas for the second exam you may expect the coverage of some cumulative information garnered throughout the term. Both exams are designed to evaluate how well you have achieved the learning outcomes of the course, and will consist of a mixture of questions in fill-in-the-blank, short answer, and essay formats. The planned exam dates are indicated in the "COURSE EVALUATION METHODS AND GRADING TIMES" section (see below), and are very unlikely to change.

DESCRIPTION OF ASSIGNMENTS

A series of two assignments with their respective instructions will be given during the term. All the references (books, articles, lecture handouts, and relevant websites) you may have cited in your assignments should be listed at the end of your assignment. Follow the American Psychological Association (APA) citation style.

DESCRIPTION OF LABS AND LAB REPORTS

At the start of each lab session, you will be provided with instructions and background information for the concepts to be illustrated. You will receive lab handouts at least a week prior to the date of performing the scheduled experiment. Your lab grade will be determined by your lab quizzes and reports, and note that the laboratory section of the course must be passed to pass the course. The lab reports should have the following sections:

1. **Title Page -** Include the title of the experiment, your name, course name and number, and date of the experiment;
2. **Introduction -** Include brief background information, the purpose and hypothesis of your experiment;
3. **Materials and Methods -** Describe the materials and experimental procedures or methods used in your experiment;

4. **Results -** Show the data or observation in graphical or tabular format and describe it in words. You must also include additional notes you made during the lab;
5. **Discussion and Conclusion -** Discuss and interpret your results, state if the results support your hypothesis, include any errors and suggestions for improvement, and summarize your experiment; and
6. **Citation -** list all the references (books, articles, lab manuals, relevant websites) you have used at the end of the report. Follow the American Psychological Association (APA) citation style.

COURSE EVALUATION METHODS AND GRADING TIMES

Exams, assignments and lab reports will be returned to you after they are marked or graded, except for the final exam. I try to get all your work graded and give you feedback within 10 working days after submission/completion. Evaluative feedback from the first assignment and first exam, in the form of numerical marks, will be provided prior to the deadline for voluntary withdrawal (see important dates below).

Your final grade will be determined by the following:

Assessment Method	% of Final Grade
Exam 1 (March 1)	20%
Exam 2 (April 16)	20%
Assignment I (Due February 17)	12.5%
Assignment II (Due March 17)	12.5%
Lab Quizzes & Reports (details will be discussed by the TA)	35%
Total	100%

GRADING SCALE

Letter Grade	Numerical Scale	Letter Grade	Numerical Scale	Letter Grade	Numerical Scale
A+	≥90 %	B	70-74 %	D	50-56 %
A	80-89 %	C+	65-69 %	F	< 50 %
B+	75-79 %	C	57-64 %		

IMPORTANT DATES

First Day of Class	January 18
Mid-Term Break	February 16-19
Voluntary Withdrawal Date	March 31
Last Day of Class	April 16

ASSIGNMENT AND LAB REPORT SUBMISSION POLICY

Assignments and lab reports are due in a week after posting and completion of the lab work, respectively, and assignments are submitted through the Assignment link UM Learn course website by 6 PM on the due date. Assignments and lab reports not submitted by the due date will be penalized 10% of the total value for each day late. Missed assignments will receive a zero grade. If a lab report is missed, an "I" (for incomplete) grade will be assigned to the student.

EARLY AND MISSED EXAMINATIONS

Exams must be written on the scheduled dates. No early exams will be given. A student who misses an exam will automatically receive a grade of zero for that exam. Only students with legitimate excuses/documentation deemed acceptable will be allowed to make up missed exams.

CLASS SCHEDULE

This schedule is subject to change at the discretion of the instructor and/or based on the learning needs of the students but such changes are subject to Section 2.8 of the – ROASS- Procedure).

Topics	Lecture Weeks (# of lectures)
1. Seed Physiology - Seed structure and its composition - Seed storage reserves: the energy to fuel early seedling growth - Seed imbibition and germination: the transition of seed embryo into a seedling - Metabolic and cellular events during germination - Physiology of seed dormancy: deciding to germinate or not to germinate - Mobilization of storage reserves and its control	Week 1-2 (5 lectures)
2. Crop growth and phenological development - Seedling emergence: phasing out dependence on storage reserves - The role of cell division in crop development - Cell walls and elongation: plant tissues plasticity and elasticity - Root formation, development and its regulation - Shoot formation and its development	Week 2-4 (5 lectures)
3. Crop canopy, photosynthesis and respiration - The life history of a leaf: why it is important? - Components of plant leaf area expansion - Leaf anatomy and its role in light interception - The development of crop canopy: leaf area index - Canopy architecture and light penetration - Photosynthesis and photorespiration - Photosynthetic response to temperature and CO_2: the greenhouse effect - Crop respiration at the field, crop and canopy level	Week 4, 6 and 7 (6 lectures)
Week 5 (February 16-19) Mid-Term Break: No Classes	
4. Mineral nutrition of crops - Essential nutrients and crop growth response - Nitrogen assimilation - Biological nitrogen fixation and its regulation - Phosphate assimilation	Week 7-8 (4 lectures)
5. The physiology of flowering in crop plants - Floral meristems and floral organ development - Floral evocation: the endogenous and exogenous cues - Biochemical signaling involved in crop flowering	Week 9 (3 lectures)
6. Seed development and pre- and post-harvest physiology - Embryogenesis and seed formation: the making of next generation plants - Assimilate translocation: pathways and patterns - Assimilate partitioning and remobilization: source-sink interaction - Deposition of storage reserves, seed maturation and desiccation - Physiology of pre-harvest sprouting: why seeds germinate on the parent plant? - Seed storage and seed longevity: what is wrong with aged seeds?	Week 10-11 (5 lectures)
7. Crop stress physiology - Flooding and hypoxic stress: the suffocation of plant tissues - Water deficit and drought tolerance - Temperature stress: the heat, the chill and the freeze - Salinity stress: the salt injury	Week 12-13 (5 lectures)

LAB SCHEDULE

We will have a total of five lab sessions, and the lab topics and the respective schedules will be discussed by the TA at the beginning of the term.

ROASS Schedule "A"

Section (a) sample re: A list of academic supports available to Students, such as the Academic Learning Centre, Libraries, and other supports as may be appropriate:

Writing and Learning Support

The Academic Learning Centre (ALC) offers writing and learning supports to help you throughout your academic program. These supports are offered online during the Covid-19 pandemic.

Make an appointment with an ALC writing tutor who can give you feedback at any stage of the writing process, whether you are just beginning to work on a written assignment or already have a draft. The ALC also has an English as an Additional Language (EAL) specialist available to work with students on improving their English-language academic writing skills.

Consult an ALC learning specialist or attend an academic skills workshop to improve your time management, learning strategies and test-taking strategies. Get support in select courses by making an appointment with an ALC content tutor. The ALC also offers peer-facilitated study groups called Supplemental Instruction (SI) for certain courses that students have typically found difficult. In SI study groups, students ask questions, compare notes, discuss content, solve practice problems, and develop new study strategies in a group-learning format.

In addition to one-to-one and group sessions, you can also find writing and study tip sheets and videos on the ALC website.

Academic Learning Centre services are free for U of M students. For more information, please visit the Academic Learning Centre website at: http://umanitoba.ca/student/academiclearning/

Contact the Academic Learning Centre by calling 204-480-1481 or emailing academic_learning@umanitoba.ca. Bannatyne students can contact the Bannatyne Student Services office at 204-272-3190.

University of Manitoba Libraries (UML)
Research begins at UM Libraries. Learn at the Libraries is a great place to start, with information for students on academic writing, how to search the library, evaluating resources, and writing citations. As the primary contact for all research needs, your liaison librarian can play a vital role when completing academic papers and assignments. Liaisons can answer questions about locating appropriate resources or managing citations, and will address any other concerns you may have regarding the research process. Liaisons can be contacted by email or phone, and are also available to meet with you online. When working remotely, students can also receive help online through Ask Us! chat. For further detail about the libraries' services and collections, visit the Libraries' web site. Regularly check our COVID-19 Update page for available library services and access to resources for Fall 2020

Section (b) sample: re: A statement regarding mental health that includes referral information:

For 24/7 mental health support, contact the Mobile Crisis Service at 204-940-1781.

Student Counselling Centre
Contact SCC if you are concerned about any aspect of your mental health, including anxiety, stress, or depression, or for help with relationships or other life concerns. SCC offers crisis services as well as individual, couple, and group counselling. *Student Counselling Centre:* http://umanitoba.ca/student/counselling/index.html
474 UMSU University Centre or S211 Medical Services Building
(204) 474-8592

Student Support Case Management
Contact the Student Support Case Management team if you are concerned about yourself or another student and don't know where to turn. SSCM helps connect students with on and off campus resources, provides safety planning, and offers other supports, including consultation, educational workshops, and referral to the STATIS threat assessment team.
http://umanitoba.ca/student/case-manager/index.html
520 UMSU University Centre
(204) 474-7423 (Student Support Intake Assistant)

University Health Service
Contact UHS for any medical concerns, including mental health problems. UHS offers a full range of medical services to students, including psychiatric consultation. Note that due to fire displacement, UHS is unable to provide in-person medical care on the Fort Garry Campus until October, 2020.
University Health Service http://umanitoba.ca/student/health/
(204) 474-8411 (Business hours or after hours/urgent calls)

Health and Wellness
Contact our Health and Wellness Educator if you are seeking information on health topics, including physical and mental health concerns, alcohol and substance use harms, or sexual violence. You can also access peer support from a *Healthy U* peer health educator.
Health and Wellness Educator
https://umanitoba.ca/student/health-wellness/welcome-about.html
britt.harvey@umanitoba.ca
469 UMSU University Centre
(204) 295-9032

Sexual Violence Resource Centre
Contact SVRC if you have experienced sexual violence or are seeking information about how to help somebody else. SVRC provides inclusive, survivor-centred, trauma-informed services, such as consultation, referrals, safety planning, and a range of on-site supports, including counselling by Klinic.
Sexual Violence Resource Centre
https://umanitoba.ca/student-supports/sexual-violence-support-and-education
svrc@umanitoba.ca
537 UMSU University Centre
(204) 474-6562 (Sexual Violence Intake and Triage Specialist)

Student Services at Bannatyne Campus
Contact SS@BC to access a full range of resources and supports for learners at the Rady Faculty of Health Sciences. Services are provided through a one-stop hub that includes a range of supports for personal and academic success, including counselling, mental health consultation, and spiritual care.
Student Services at Bannatyne Campus
https://umanitoba.ca/student-supports/student-services-bannatyne-campus
bcss@umanitoba.ca
S211 Medical Services Building
(204) 272-3190 (Intake and Triage Specialist

Section (c) sample: re: A notice with respect to copyright:

All students are required to respect copyright as per Canada's *Copyright Act*. Staff and students play a key role in the University's copyright compliance as we balance user rights for educational purposes with the rights of content creators from around the world. The Copyright Office provides copyright resources and support for all members of the University of Manitoba community.
Visit http://umanitoba.ca/copyright for more information.

Section (d) sample: re: A statement directing the student to University and Unit policies, procedures, and supplemental information available on-line:

Your rights and responsibilities
As a student of the University of Manitoba you have rights and responsibilities. It is important for you to know what you can expect from the University as a student and to understand what the University expects from you. Become familiar with the policies and procedures of the University and the regulations that are specific to your faculty, college or school.

The Academic Calendar http://umanitoba.ca/student/records/academiccalendar.html is one important source of information. View the sections *University Policies and Procedures* and *General Academic Regulations*.

While all of the information contained in these two sections is important, the following information is highlighted.

- If you have questions about your grades, talk to your instructor. There is a process for term work and final **grade appeals**. Note that you have the right to access your final examination scripts. See the Registrar's Office website for more information including appeal deadline dates and the appeal form http://umanitoba.ca/registrar/

- You are expected to view the General Academic Regulation section within the Academic Calendar and specifically read the **Academic Integrity** regulation. Consult the course syllabus or ask your instructor for additional information about demonstrating academic integrity in your academic work. Visit the Academic Integrity Site for tools and support http://umanitoba.ca/academicintegrity/ View the **Student Academic Misconduct** procedure for more information.

- The University is committed to a respectful work and learning environment. You have the right to be treated with respect and you are expected conduct yourself in an appropriate respectful manner. Policies governing behavior include the:

  Respectful Work and Learning Environment
  http://umanitoba.ca/admin/governance/governing_documents/community/230.html

  Student Discipline
  http://umanitoba.ca/admin/governance/governing_documents/students/student_discipline.html and,

  Violent or Threatening Behaviour
  http://umanitoba.ca/admin/governance/governing_documents/community/669.html

- If you experience **Sexual Assault** or know a member of the University community who has, it is important to know there is a policy that provides information about the supports available to those who disclose and outlines a process for reporting. The **Sexual Assault** policy may be found at: http://umanitoba.ca/admin/governance/governing_documents/community/230.html More information and resources can be found by reviewing the Sexual Assault site http://umanitoba.ca/student/sexual-assault/

For information about rights and responsibilities regarding **Intellectual Property** view the policy: https://umanitoba.ca/admin/governance/governing_documents/community/235.html

For information on regulations that are specific to your academic program, read the section in the Academic Calendar and on the respective faculty/college/school web site http://umanitoba.ca/faculties/

Contact an **Academic Advisor** within our faculty/college or school for questions about your academic program and regulations http://umanitoba.ca/academic-advisors/

Student Advocacy
Contact Student Advocacy if you want to know more about your rights and responsibilities as a student, have questions about policies and procedures, and/or want support in dealing with academic or discipline concerns.
http://umanitoba.ca/student/advocacy/
520 University Centre
204 474 7423
student_advocacy@umanitoba.ca