

SYLLABUS 202302

BIO 58000 Special Topics in BIO: Climate Change, Plant Health and Food Security

Instructor: Levent Ozturk (lozturk@sabanciuniv.edu)

Resources: Instructor slides, student presentation slides, articles from Q1 journals, SUCourse etc. (all resources are restricted for redistribution and may be subject to copyrights)

Contents

Climate change is predicted to adversely affect plant production in most of the agricultural areas around the world. Many established agricultural production systems are being questioned for their vulnerability to climate change, forcing farmers to adopt new management practices and modify their traditional cropping systems.

“Climate Change, Plant Health and Food Security” course will study climate change variables in two sections. The first section will discuss the variables that have a broader and direct effect, viz., (i) elevating atmospheric carbon dioxide (eCO₂) and (ii) rising global temperature. The second section will highlight localized effects of climate change (i.e. changing precipitation patterns, heat waves, frequency of agricultural droughts) on plant health and food security.

In the first section, the contradictory interactions of eCO₂ and high temperatures will be examined in light of recent literature. It is known that eCO₂ alone can bring about significant profit in gross agricultural production, mostly by means of cultivation of C₃ crop species and due to increased carbon abundance and the concomitant water-use efficiency. However, students will comprehend that the rising global temperatures challenge any optimistic predictions about the effect of global climate change on crop productivity. In the final part of the first section, students will be given the task of performing a literature review on effects of major climate change variables on deterioration of the nutritional value of cereal grains (i.e. due to enhanced carbohydrate accumulation and thus dilution of protein and micronutrients in grain tissue).

The second section will focus on increases in frequency and severity of abiotic stressors including but not limited to heat, drought, waterlogging, and salinity as a consequence of changes in the local climate. Topics will extend to impact of global and local climate change variables on crop pests and diseases. Potential effects of climate change-induced biotic stress factors will be discussed in particular of farm biosecurity and food security.

In the final section of the course, mitigation, and adaptation strategies for tackling local and global climate change variables will be introduced. Strengths and weaknesses of current breeding and agricultural management strategies will be discussed.

Learning Outcomes

Climate change is a pressing challenge with particular effects on plant health and productivity. There is an urgent need to increase the awareness of young researchers about possible effects of individual climate change variables on plant physiology and stress tolerance. This course will highlight potential mitigation and adaptation strategies to tackle adverse effects of predicted local and global climate change variables to sustain agricultural productivity and thus food security. It is expected to inspire students and divert their interest on this global challenge. Upon successful completion of this course, students should be able to:

- Define broad and local climate change variables acting on plant health and productivity.
- Explain the contradictory effects of eCO₂ and rising atmospheric temperatures on crop yields.
- Comprehend how localized effects of climate change e.g. changing precipitation patterns, heat waves, agricultural droughts, water logging and salinity can impact global food security.
- Explain why nutritional quality of cereal grains can deteriorate due to global climate change.
- Explain why pests and diseases can threaten farm biosecurity and food security due to changing climate variables at local and global scale.
- Explain strengths and weaknesses of potential mitigation and adaptation strategies for tackling local and global climate change variables on plant health and productivity.

Assessment

- Lecture attendance (students who miss to attend >15% of class meeting hours cannot take the final exam)
- Student presentations (30%)
- Proposal writing (30%)
- Final exam (40%)

Presentation/final exam attendance, Make-up, Ethics

Absence in own presentation session and/or the final exam results in a zero grade. Missing to submit the proposal in due time also results in a zero grade. There will be no scheduled make-ups for these assessment items. In case of an emergency with a valid excuse (*e.g.*, a written proof of doctor's report, accident report, etc.) the instructor must be informed within the same week. In such a case, a separate assessment (in a structured essay format) will be given at a time and date determined by the instructor. Sabanci University's regulations on plagiarism and cheating will be strictly enforced on students who help, attempt, or conduct any form of cheating. Assessment materials will be check by plagiarism software.

WEEKLY SCHEDULE (subject to change)

Week	Activity
1	The “unnatural” face of climate change
2	Is elevating atmospheric carbon dioxide friend or foe for plants?
3	Climate change comes with multiple components
4	Plant Adaptations to the Environment
5	How is crop quality affected by the change?
6	The link between climate change, malnutrition, and immunity
7	Food security vs. nutrition security
8	Plant health and contrasting effects of climate change: drought, salinity, flooding
9	Plant pests and diseases influenced by changing climates
10	A SWOT analysis of potential mitigation and adaptation strategies
11	Student presentations and proposals
12	
13	
14	