UNIVERSITY OF SARGODHA

DEPARTMENT OF AGRONOMY, COLLEGE OF AGRICULTURE

COURSE OUTLINE Winter 2020-2021

Course Title: Crop Management under Stressful Environments

Course Code: AGRO-403

Credit Hours: 3(2-1)

Instructor: Dr Muhammad Ehsan Safdar

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| **DESCRIPTION** |

This course will enable the students to understand various stresses under field conditions and use agro-management practices for successful crop production under the influence of these stresses and ultimately getting higher yields.

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| **LEARNING OUTCOMES** |

1. To introduce the students with concept of stress.
2. To enable students to identify various stressful conditions under field conditions.
3. To describe the plant responses to various stresses.
4. To explain various adaptations of plants under stressed environments.
5. To acquaint students with approaches and techniques to cope with stresses.
6. To enable students to get optimum crop yields under stressful environments.

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| **CONTENTS** |

**Theory**

Components of crop productivity; Crop environment and its components; Environmental optima for crop growth and development; Concept of stress and stressful environments under field conditions. Modifications in growth and developmental patterns of crop plants under biotic and abiotic stresses. Approaches for ameliorating the stress effects for crop production.

**Practical**

Acquaintance with the symptoms of stresses on crop, visits to affected areas and noting the patterns of vegetative and reproductive growth of crop plants.

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| **READINGS** |

1. Arnon, I. 1992. Agriculture in Dry Lands: Principles and Practices. Elsevier Amsterdam.

2. Nosberger, J.H. H.Geiger and P.C. Struik. 2001. Crop Science Progress and Prospects. CABI Pub., Oxon, UK.

3. Pessaraskli, M. A. 2000. A. Hand Book of Stress Physiology, Marker and Deekar.

4. Taize, L., E. Zeiger. 2006. Plant Physiology. Sinauer Pub. U.S.A.

5. Turner, N.C. and P.J. Kramer. 1980. Adaptation of plants to water and high temperature stress.

6. Nazir, S., Bashir, E. and Bantel, R., 1994. Crop production. National Book Foundation, Islamabad, 348.

7. Rashid, A. 1996. Soil Science. National Book Foundation, Islamabad.

8. Crop physiology and productivity By Jeuffroy and Ney Review article of Field Crops Research 53 (1997): 3-16.

9. Venkateswarlu, B., Shanker, A. K., Shanker, C., & Maheswari, M. (Eds.). 2011. *Crop stress and its management: perspectives and strategies*. Springer Science & Business Media.

10. Shabala, S. (Ed.). 2017. Plant Stress Physiology. Cabi.

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| **COURSE** |

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| **Week** | **Topics and Readings** | **Book with Page No.** |
| 1 | Introduction of the course. | Scheme of studies of BSc (Hons) Agriculture |
| Dictation & discussion about the course contents. |
| 2 | Concept of stress and stressful environments | Book 4 Chapter 25, Page 591-607 |
| An over-view of various types of stress sources / factors. |
| 3 | Crop environment and its components | Book 6 Chapter 3, Page 27-44 |
| Introduction to the role of the environment in plant growth and development. |
| 4 | Overview of Plant Stresses: Mechanisms, Adaptations and Research Pursuit: Introduction, Significance of stresses in crop plants | Book 9, pages 1-15 |
| Improving Stress Tolerance – Conventional and Molecular Approaches |
| 5 | Stress in Plantation Crops: Adaptation and Management: Adaptations to abiotic stresses: Drought, Temperature | Book 9, pages 45-66 |
| Adaptation to Abiotic Stresses: Salinity, Radiation, Nutrient stress |
| 6 | Adaptation to Abiotic Stresses: Pollution, Flooding, Fire, Wind, Lightening, Erosion, Climate change | Book 9, pages 66-85 |
| Adaptation to biotic Stresses |
| 7 | Management of Stresses | Book 9, pages 85-110  Book 1, Page 229-233 |
| Plant adaptations to moisture stress: Categories of drought and drought resistance, Drought Escape |
| 8 | Drought avoidance and tolerance, and their mechanisms. | Book 1, pages 233-245 |
| Dehydration tolerance |
| **9** | **Mid Term Test (December 14-18, 2020)** | |
| 10 | Salinity stress and its types. | Book 7, Page 477-492 |
| Plant responses to salinity stress. |
| 11 | Salinity Stress- soil, osmotic and photosynthesis effects | Book 4, Page 611-613 |
| Salinity Stress- Plant strategies to avoid salinity stress |
| 12 | Salinity stress: Physiological constraints and adaptive mechanisms | Book 7, Page 493-495.  Book 10, pages 50-83 |
| Management practices for successful crop production in saline soils. |
| 13 | Heat Stress and Heat Shock | Book 4, Page 602-605 |
| Plant adaptations to heat stress |
| 14 | Chilling and Freezing injuries | Book 4, Page 607-610 |
| Plant resistance to freezing temperature |
| 15 | Oxygen Deficiency stress-Effects | Book 4, Page 616-618 |
| Oxygen Deficiency stress-Adaptations | Book 4, Page 618-620 |
| 16 | Flooding tolerance in plants | Book 10, pages 148-163  Review article 8 |
| Components of crop productivity |
| 17 | Heavy metal toxicity in plants | Book 10, pages 210-230  Book 10, pages 291-304 |
| Biotic stress signalling: calcium mediated pathogen defense program |
| 18 | **Final Exam (February 8-12, 2020)** | |

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| **RESEARCH PROJECT / PRACTICAL / LABS** |

1. Importance of soil bioassay studies for noting stress symptoms on crops.
2. Procedure to soil bioassay studies for noting stress symptoms on crops.
3. Soil Collection and pot filling for bioassay studies. (Laboratory activity)
4. How to recognize stress symptoms from stressed plants (http://www.gardeners.com/how-to/plant-stress/7341.html)
5. Imposition of salinity, drought, heat, chilling and water-logging stresses on potted wheat plants. (Laboratory activity).
6. Noting visual symptoms on stressed seedlings of potted wheat.
7. (Laboratory activity).
8. Recording data related to root and shoot growth of stressed and unstressed wheat seedlings.

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| **ASSIGNMENT CRITERIA** |

Sessional: 25%, Project: 25%, Presentation: 25%, Participation: 25%