

**University of Jordan Dept. Horticulture & Crop Science**

**Faculty of Agriculture Semester: 1st semester 2018/2019**

**Breeding for Stress Environment** (0601936)

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| **Credit hours** | 3 | **Level** | Ph.D. | **Pre-requisite** |  |
| **Lecturer** | Dr. Monther Sadder | **Office #** | 212 | **Office phone** |  |
| **Course website** |  | **E-mail** | sadderm@ju.edu.jo | **Place** |  |

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| --- | --- | --- | --- | --- | --- |
| **Office hours** | | | | | |
| **Day/Time** | **Sunday** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** |
|  | 9-10 a.m. |  | 9-10 a.m. |  | 9-10 a.m. |

**Course Description:**

This course covers breeding for various stresses, such as drought, heat, cold, minerals and salinity in terms of genetics and breeding methodology. The course also covers recent research topics in relation to breeding for stress environment.

**Learning Objectives:**

Abiotic stress is the stress imposed on plants by the non-living environment. Abiotic stress is responsible for huge yield losses in crops around the world. In this course we will assess the impact that abiotic stresses (drought, salinity, nutrient deficiency) have on agricultural production, and provide you with knowledge and tools for successful breeding for abiotic stress tolerance. The following questions will be addressed:

1. What can agriculture do to minimize yield losses now and in a future where the climate changes, and input will be further restricted?
2. What are the requirements for successful breeding for abiotic stress tolerance?
3. How does a plant respond to abiotic stress, and which physiological and molecular mechanisms are important?
4. Which traits contribute to stress tolerance, how can these be measured and used for selection?
5. How do modern genomics techniques contribute to abiotic stress tolerance breeding?

**Intended Learning Outcomes:**

1. **knowledge and understanding:**

A1. How agriculture, crops and individual plants are affected by abiotic stress

A2. Main mechanisms that help plants to cope with abiotic stress

A3. Tools that can be used to monitor and understand the response and tolerance of plants to different abiotic stresses.

A4. Integration of the above knowledge for the design of a sensible breeding strategy for the improvement of abiotic stress tolerance in target crops.

1. **Intellectual analytical and cognitive skills:**

B1. Different abiotic stresses on plants.

B2. Critical genetic responsive elements affected by environmental factors.

B3. Requirements for successful breeding for abiotic tolerance.

B4. Interaction between major biomarkers under multiple stresses.

1. **Subject-specific skills:** Student is expected to

C1. Show high concentration and hand work dedicated to the scope of abiotic stress diagnosis.

C2. Understand biodiversity and genetic resources to be integrated in breeding for stress tolerance.

C3. Understand genetic controlling elements, both static (genome) and adaptive (epigenome) in major crop species.

C4. Be aware of advances technologies of molecular breeding to improve stress tolerance.

1. **Transferable key skills:** Student is expected to know

D1. Lab practical work, precession and time management

D2. Drawing and illustrations of solid data into elastic easy to follow scheme

D3. Data analysis and interpretation

D4. Reporting data in a proper way and understanding scientific articles

**ILOs Learning and Evaluation Methods**

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| **ILO/s** | **Learning Methods** | **Evaluation Methods** |
| A1-A6 | Lectures and discussions | Quiz, Exam |
| B1-B4 | Lectures, discussions and  Presentations | Quiz, Exam, Assignment |
| C1-C4 | Lectures, discussions and  Presentations | Quiz, Exam, Assignment |
| D1-D4 | Lectures, discussions and  Presentations | Quiz, Exam, Assignment |

**Course Contents**

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| **Content** | **Reference** | **Weeks** | **ILOs** |
| Review of plant genetics | Lectures, Article | 1 | A4, B1, B2, C1, C2, D1, D4 |
| Review of plant breeding | Lectures, Article | 1 | A4, B1, B2, B4, C1, D1, D4 |
| Plant abiotic stresses | Lectures, Article | 1 | A4, B2, C1, C2, C3, D2 |
| Abiotic stress signaling | Lectures, Article | 2 | A4, B4, C1, D4 |
| Abiotic genomics | Lectures, Article | 2 | A3, A5, B3, C1, D2, D4 |
| Abiotic epigenomics | Lectures, Article | 2 | A1, A2, B1, C1, C2, C3, D3, D4 |
| Salinity stress | Lectures, Article | 2 | A1, B1, B4, C1, D4 |
| Drought stress | Lectures, Article | 2 | A3, A5, B2, B4, C1, C4, D3, D4 |
| Heat stress | Lectures, Article | 1 | A3, A4, A5, B3, C1, C2, D3, D4 |
| Cold stress | Lectures, Article | 1 | A4, B2, B4, C1, C3, D4 |
| Other stresses | Lectures, Article | 1 | A2, A4, A5, B3, C1, C4, D4 |

**Learning Methodology**

## This course will be structured in

## Lectures and discussions,

## Presentations of recent articles

## Lab project

# Evaluation

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| **Evaluation** | **Point %** | **Date** |
| **Midterm Exam** | 30 | After 10 weeks |
| **Discussion & Quizes** | 15 | After 4, 6 and 12 weeks |
| **Presentation** | 15 | As indicated in table above |
| **Final Exam** | 40 | Determined by Registration Dept. |

**References**

1. Brown J., Caligari P., Campos H. (2014): Plant Breeding. 2nd Edition of Introduction to
2. Plant Breeding – revised and updated, Blackwell Publishing.
3. Acquaah, G. (2009). Principles of plant genetics and breeding. John Wiley & Sons.
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B. and Doebley, J. (2015) Introduction to Genetic Analysis. 11th edition. Freeman, USA.
5. Chakraborty, U., & Chakraborty, B. (Eds.). (2015). Abiotic Stresses in Crop Plants. CABI.
6. Sarwat, M., Ahmad, A., Abdin, M. Z., & Ibrahim, M. M. (Eds.). (2016). Stress Signaling in Plants: Genomics and Proteomics Perspective (Vol. 1). Springer.
7. Selected papers.