

SYLLABUS: DEPARTMENT OF CROP PHYSIOLOGY

Courses offered by Department of Crop Physiology in M.Sc. (Ag.) programme

Course No.	Name of the Course	Credit Hours	Semester
CPH 501	Stress physiology	2+1	I
CPH 502	Mineral nutrition of plants	2+1	II

CPH 501 : Stress physiology 2+1

Objectives:

To study various types of stresses in crop production and strategies to overcome them.

Syllabus:

Theory

UNIT I

Response of plants to abiotic stress: Abiotic stresses affecting plant productivity, interactions between biotic and abiotic stresses.

UNIT II

Drought characteristic features, water potential in the soil-plant-air continuum. Development of water deficits, energy balance concept.

UNIT III

Transpiration and its regulation – stomatal functions.

UNIT IV

Physiological processes affected by drought. Drought resistance mechanism: Escape, dehydration postponement (drought avoidance), dehydration tolerance and characteristics of resurrection plants, osmotic adjustment, osmoprotectants, stress proteins, water use efficiency as a drought resistant trait. Water logging and flooding injury. Molecular responses to water deficit: expression of regulatory and functional genes and its significance.

UNIT V

Stress and determined hormones – ABA as a signaling molecule – Cytokinin as a negative signal. Oxidative stress: Relative Oxygen Species (ROS), role of scavenging systems (SOD catalase etc.).

UNIT VI

Stress due to high temperature: heat wave tolerance mechanisms – role of membrane lipids in high temperature tolerance, functions of HSP's.

UNIT VII

Low temperature stress: Chilling and freezing stress, frost and cold injury effects on physiological process, crucial role of membrane lipids.

UNIT VIII

Salinity: Species variation in salt tolerance, salinity effects at – Cellular and whole plant level, tolerance mechanisms, salt tolerance in – Glycophytes and halophytes.

UNIT IX

Heavy metal stress: Aluminum and cadmium toxicity in acid soils, role of phytochelatin (heavy metal binding proteins).

Practical

Determination of proline content of plant parts; determination of Relative Leaf water content of plants; Quantification of anti oxidative enzymes like Super oxide desmutase (SOD); Determination of membrane injury index (MII); Determination of chlorophyll stability index (CSI) ; Studying the effect of ABA / Cytokinin on stomatal behavior.

Learning Outcome:

The students will understand various aspects of stress physiology such as physiological and molecular basis of abiotic stress tolerance in plants; the knowledge in stress physiology will be useful for developing climate resilient genotypes for sustainable crop production.

CPH 502 : Mineral nutrition of plants

2+1

Objectives:

To impart knowledge about physiological and molecular aspects of carbon reduction cycle and nitrogen assimilation

Syllabus:

Theory

UNIT I

Overview of essential mineral elements, forms of plant nutrients, Role of mineral nutrients in plants, Deficiency Symptoms, Mechanism of nutrient uptake by plants, Factors influencing mineral absorption in plants.

UNIT II

Nutrient uptake by root cells and foliar absorption of nutrients, long distance transport in plants and movement into developing grains, Nutrient transport from vegetative to reproductive organs during reproductive stage of growth and maturity.

UNIT III

Molecular mechanism of ion uptake, ion transporters, specific examples of transporters for Nitrate, Phosphate, Potassium and other nutrients.

UNIT IV

Molecular physiology of micronutrient acquisition, Genes encoding mineral ion transporters. Strategies plants adopt to acquire and transport minerals under deficient levels.

UNIT V

Physiological and molecular mechanisms underlying differential nutrient efficiency in crop genotypes, Phosphorous, Iron and Zinc efficient crop varieties.

UNIT VI

Plant responses to mineral toxicity.

Practical

Physiological and biochemical changes in plants under nutrient sufficiency and deficiency levels. Quantification of pigment levels, enzyme activities.

Learning Outcome:

The students will understand various aspects of mineral nutrition of plants such as physiological and molecular basis of mineral ion uptake and utilization in plants; the knowledge in mineral nutrition will be useful for improving nutrient use efficiency of crops for achieving higher productivity.