PPHY261 CROP PHYSIOLOGY (2+1)

AIM

To expose the students to the basic concepts and underlying application of Crop Physiology

THEORY

UNIT I: PLANT WATER RELATIONS

Introduction – **review on plant anatomy** - Importance of crop physiology in agriculture, Role and significance of water - diffusion, imbibitions, osmosis and its significance, plasmolysis, Definitions - field capacity, water holding capacity of soil and permanent wilting point, Absorption of water - mode of water absorption – active and passive absorption and factors affecting absorption, Translocation of solutes - phloem and xylem transport, Transpiration - types - Steward's theory of mechanism - significance, factors affecting transpiration and guttation - antitranspirants.

UNIT II: NUTRIO PHYSIOLOGY

Mineral nutrition - introduction - criteria of essentiality of elements - macro, secondary and micronutrients - sand and soil less culture- hydroponics, Mechanism of uptake - physiological role of nutrients, Foliar diagnosis - nutritional and physiological disorders - foliar nutrition and fertigation **.**

UNIT III : PHOTOSYNTHESIS& RESPIRATION

Photosynthesis - requirements of photosynthesis - light, CO_2, pigments and water, Mechanism of photosynthesis - light reaction - cyclic and non cyclic photophosphorilation - Red drop - Emerson Enhancement Effect, Photosynthetic pathways - C3, C4 and CAM, Differences between C_3, C_4 and CAM pathways - Factors affecting photosynthesis, Photorespiration - photorespiration process and significance of photorespiration, Respiration - Glycolysis, TCA and Pentose Phosphate Pathway, Oxidative phosphorylation - differences between oxidative phosphorylation and photophosphorylation. Respiratory quotient and energy budgeting in respiration.

UNIT IV : GROWTH PHYSIOLOGY

Growth - growth curve, phases of growth and factors influencing growth, Growth analysis - LAI, LAD, SLW, SLA, LAR, NAR, RGR and CGR in relation to crop productivity,- Source sink relationship - Photoperiodism - Role of phytochrome in flowering and regulation of flowering. Transmission of stimulus - theories of flowering-Vernalisation – devernalisation- Protein and fat synthesis- Plant growth regulators - growth hormones - definition and classification - physiological role of auxins and GA, Physiological role of Cytokinin, Ethylene and ABA - synthetic growth regulators and their uses in crop productivity, Practical application of Plant Growth Regulators in crop productivity

UNIT V : STRESS PHYSIOLOGY

Environmental stresses - water stress - physiological changes - adaptation to drought and amelioration, Temperature stress - Physiological changes - low and high temperature - chilling injury - tolerance – alleviation, Low light and UV radiation stresses - salt stress - physiological changes and alleviation, Global warming – **Carbon Sequestration** physiological effects on crop productivity, Seed germination - physiological changes during seed germination,. Abscission – senescence- **ripening** - types, causes, physiological and biochemical changes and regulation.

PRACTICALS

UNIT I : PLANT WATER RELATIONS

Preparation of solutions – **Anatomical textures of plant body** - Measurement of plant water status - Relative Water Content - Measurement of transpiration - studying the structure of stomata - Stomatal Index.

UNIT II : NUTRIO PHYSIOLOGY

Identification of Physiological disorders - Nutritional disorders in crops plants - Rapid tissue testing methods - Field visit for foliar diagnosis

UNIT III : PHOTOSYNTHESIS& RESPIRATION

Estimation of plant pigments in crop plants - determination of photosynthetic efficiency - differences in C_3 and C_4 plants - estimation of soluble protein.

UNIT IV : GROWTH PHYSIOLOGY

Measurement of leaf area by different methods - Growth analysis Practical application of plant growth regulators. . -

UNIT V ; STRESS PHYSIOLOGY

Estimation of Chlorophyll Stability Index and proline content - Elevated CO_2 and crop productivity.

LECTURE SCHEDULE

1. Introduction - Importance of crop physiology in agriculture.
2. Role and significance of water - diffusion, imbibition, osmosis and its significance, plasmolysis.
3. Definition - field capacity, water holding capacity of soil and permanent wilting point.
4. Absorption of water - mode of water absorption – active and passive absorption and factors affecting absorption.
5. Translocation of solutes - phloem and xylem transport.
6. Transpiration - types - Steward's theory of mechanism - significance, factors affecting transpiration and guttation - antitranspirants.
7. Mineral nutrition - introduction - criteria of essentiality of elements - macro, secondary and micronutrients - soil less culture - sand and hydroponics.
8. Mechanism of uptake - physiological role of nutrients.
9. Foliar diagnosis - nutritional and physiological disorders - foliar nutrition- fertigation
10. Photosynthesis - requirements of photosynthesis - light, CO_2, pigments and H_20.
11. Mechanism of photosynthesis - light reaction - cyclic and non cyclic photophosphorylation - Red drop - Emerson Enhancement Effect.
12. Photosynthetic pathways - C_3, C_4 and CAM.
13. Differences between C_3, C_4 and CAM pathways - Factors affecting photosynthesis.
14. Photorespiration - photorespiration process and significance of photorespiration.
15. Respiration - Glycolysis, TCA and Pentose Phosphate Pathway.
16. Oxidative phosphorylation - differences between oxidative phosphorylation and photophosphorylation. Respiratory quotient and energy budgeting in respiration.
17. Factors affecting respiration - difference between photorespiration and dark respiration - role of respiration.
18. Protein and fat synthesis.
19. Photoperiodism - short day, long day and day neutral plants - phytochrome. Role of phytochrome in flowering and regulation of flowering.
20. Transmission of stimulus - theories of flowering.
21. Vernalisation - mechanism of vernalisation and its significance - devernalisation.

22. Source sink relationship - yield components - harvest index and its importance
23. Growth - growth curve, phases of growth and factors influencing growth
24. Growth analysis - LAI, LAD, SLW, SLA, LAR, NAR, RGR and CGR in relation to crop productivity.
25. Plant growth regulators - growth hormones - definition and classification - physiological role of auxins and GA.
26. Physiological role of Cytokinin, Ethylene and ABA - synthetic growth regulators and their uses in crop productivity.
27. Practical application of Plant Growth Regulators in crop productivity.
28. Environmental stresses - water stress - physiological changes - adaptation to drought and amelioration.
29. Temperature stress - Physiological changes - low and high temperature - chilling injury - tolerance - alleviation.
30. Low light and UV radiation stresses - salt stress - physiological changes and alleviation.
31. Global warming - **Carbon Sequestration** -physiological effects on crop productivity.
32. Seed germination - physiological changes during seed germination.
33. Abscission - senescence – **ripening**- types, causes, physiological and biochemical changes and regulation.

REFERENCES

1. Jain, J.K. 2007. Fundamentals of plant physiology, S.Chand & Company Ltd., New Delhi.
2. Pandey, S. N. and B. K.Sinha, 2006. Plant Physiology. Vikas Publishing House Private Limited, New Delhi.
3. Purohit, S.S, 2005. Plant physiology, Student edition, Jodhpur.
4. Ray Noggle, G. and Fritz, G. J., 1991. Introductory Plant Physiology. Prentice Hall of India Pvt. Ltd., New Delhi.
5. Taiz. L. and Zeiger. E., 2006. Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

ONLINE REFERENCE

1. **http://www.plantphys.org**
2. **http://www. Biologie. Uni-hamburg. de/b-online**
3. **http://4e.plantphys.net**
4. **http://3e.plantphys.net**
5. **http://www.botany.org**