

SEMESTER END EXAMINATION

B.Sc. (Hons.) Agriculture

Semester : II (New)	Term : II	Academic Year : 2017-18
Course No. : BOT 121	Title : Fundamentals of Crop Physiology	
Credits : 2 (1+1)		
Day & Date : Friday, 27.04.2018	Time : 09.00 to 11.00	Total Marks : 40

- Note :**
1. Solve ANY EIGHT questions from SECTION "A".
 2. All questions from SECTION "B" are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1** Define Crop Physiology. Describe the scope and importance of Crop Physiology in agriculture.
- Q.2** Define plant cell. Describe functions of the following cell organelles.
a) Nucleus
b) Chloroplast
c) Mitochondria
d) Endoplasmic reticulum
- Q.3** Write in detail about pathway of water across the root cells. Enlist the different factors affecting the rate of absorption.
- Q.4** Define Photosynthesis. Describe in detail about the dark reaction. Enlist the factors affecting photosynthesis.
- Q.5** Define respiration and describe the reaction of Krebs's cycle.
- Q.6** Define plant growth hormones and classify it. Write in detail about physiological role of Auxins in plant.
- Q.7** Define transpiration. What are the types of transpiration? Enlist the factors that affect rate of transpiration.
- Q.8** Distinguish between the following (Any Two).
a) Osmosis and diffusion
b) C₃ and C₄ Plant
c) Active absorption and passive absorption.
- Q.9** Enlist the criteria for essentiality of nutrient elements and write in short deficiency symptoms and function of following elements in the plants.
a) Nitrogen
b) Copper
- Q.10** Write short notes (Any two).
a) Hydroponics
b) Photorespiration
c) Source-sink relationship

SECTION "B"

- Q.11** Fill in the blanks.
- 1) Light reaction of Photosynthesis takes place in _____.
 - 2) End product of _____ is pyruvic acid.
 - 3) The breakdown of water molecule into H^+ ions and OH^- ions in the presence of light is called _____.
 - 4) _____ is a fruit ripening hormone.
- Q.12** Give full form of the following.
- | | | | |
|--------|--------|--------|--------|
| 1) CAM | 2) DPD | 3) PGA | 4) CCC |
|--------|--------|--------|--------|



Model answer

MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD,
PUNE.

SEMESTER END EXAMINATION

B.Sc. (Agri)

Semester : II (New)

Course No: - Bot -121

Credits : 2 (1+1)

Day & Date :

Academic Year : 2017-18

Title : Fundamentals of Crop Physiology

Time : 2hrs.

Total Marks : 40

- Note :-
1. Solve Any Eight questions from Section 'A'.
 2. All questions from Section 'B' are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION 'A'

Q. 1 Define Crop Physiology. Describe the scope and Importance of Crop Physiology in Agriculture.

Ans :- Crop physiology can be defined as systematic application of knowledge of natural processes occurring in crop plant and fundamental principles of plant physiology for efficient crop production.

Scope :- It is the object of plant physiology to study, analyse, invent, investigate, interpret all the life processes of the plants to study the effect of various factors upon these life processes and if possible to solve the nature of life. This involves a study of the function of the various plant organs, tissues, etc.

Importance:

- 1) By increasing photosynthesis efficiency to convert solar radiations into growth crop production can be increased.
- 2) Improved biological nitrogen fixation can be possible through physiological techniques which can reduce use of expensive chemical fertilizers.
- 3) Tissue culture and cell fusion techniques developed by plant physiologist can be used to breed desirable strains of crop plants.
- 4) Use of growth regulators to increase crop production.

Q.2 Define plant cell ? Describe the function of following cell organelles

- a) Nucleus b) Chloroplast c) Mitochondria d) Endoplasmic reticulum

Ans: Plant Cell : Cell is structural and functional unit of living beings. Plant cell is community of microscopic structure or units called the cells.

- a) **Nucleus:** It controls heredity and other activities of cells. It also controls synthesis of enzymes which catalyzed most of reactions in plant cells. It controls physiology of the cells.
- b) **Chloroplast:** photosynthesis in plants. Synthesize starch.
- c) **Mitochondria:** Transport of water and nutrients. Forms centriols, basal granules, cilia flagella, spindle, astral rays etc.
- d) **Endoplasmic reticulum:** Forms a skeletal support to cytoplasm matrix, acts as vascular system in cell transporting various substances. Stores and synthesize lipids, glycogen, cholesterol and proteins.

Q.3 Write in detail about pathway of water across the root cells. Enlist the different factors affecting rate of absorption.

Ans :- **Pathway of Water in Root :-** The water is absorbed from the soil by the root hair cells. From the root hair cell, the water reaches the leaves by passing through a number of cells. From the root hair, the water reaches the endodermis. The endodermal cells lying opposite to root hairs are specially modified to transport the absorbed water. These endodermal cells are called passage cells. The passage cells are permeable to water because they lack casparian thickening and are impermeable to water.

The water from the passage cells pass into the pericycle cells. From the pericycle cells the water passes into the xylem cells. Through the xylem tubes, the water moves up through stem xylem to leaf xylem. The root hair, passage cells and xylem cells are in a line to facilitate easy movement of water. The water movement from one cell to another is brought about by turgor pressure.

External Environmental factors

- 1) Available Soil Water
- 2) Concentration of soil solution
- 3) Soil temperature and Soil aeration

Internal Environmental Factors

- 1) Transpiration
- 2) Absorbing root system
- 3) Metabolism

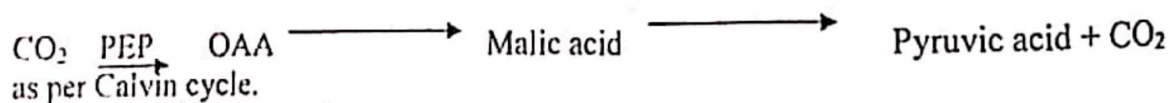
Q.4 Define Photosynthesis. Describe in detail about the dark reaction. Enlist the factors affecting photosynthesis.

Ans :- **Photosynthesis** is defined as the process in which certain carbohydrates are synthesized from CO_2 and water by chlorophyll cells in the presence of light. Oxygen being a by product.

Dark reaction :- In dark reaction the hydrogen (which is produced during light reaction) is transferred to CO_2 , the reduction of CO_2 then proceeds rapidly in a stepwise manner under the action of several enzymes.

The reduction of CO_2 in stepwise manner with the help of several enzymes to the formation of sugars and starch and regeneration of (RuDP) ribulose 1,5, di-phosphate is called dark reaction.

First stable product of Calvin cycle or C₃ plant is 2 molecules of 3 phosphoglyceric acid (PGA). This is 3 C compound. It is operated in dicot plants. But in HSK pathway (C₄ plant) the 1st stable product is oxaloacetic acid. It is 4C compound. In HSK pathway CO_2 is fixed by phosphoenolpyruvic acid. But in Calvin cycle it is fixed by Ribulose -1-5 diphosphate (RuDP). HSK pathway is operative in monocot plants.



External Factors :- 1) Light 2) Carbohydrates 3) Temperature 4) Water 5) Oxygen

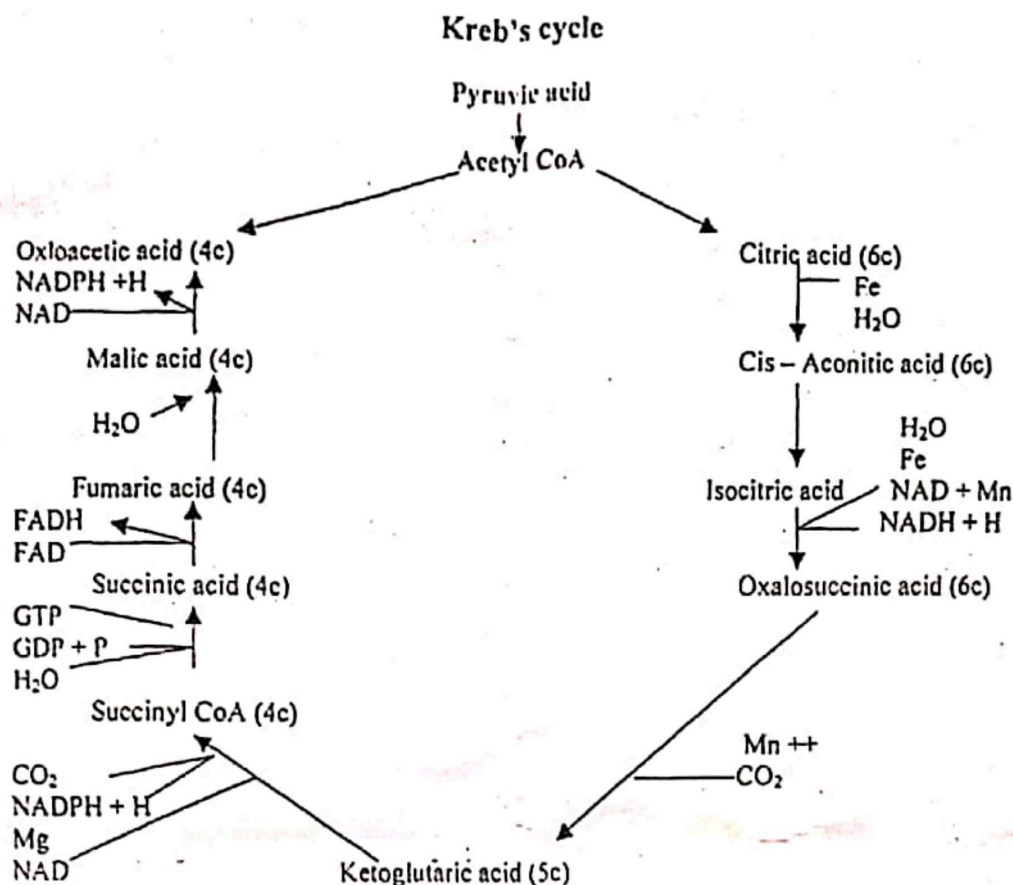
Internal Factors :- 1) Chlorophyll content 2) Protoplasmic factor 3) Leaf 4) Phytohormone

Q.5 Define respiration and describe the reaction of Krebs's cycle ?

Ans :- **Respiration** is the process of biological oxidation where oxygen is utilized and CO_2 evolved for the purpose of releasing energy.

Krebs's cycle:- With the help of O_2 , pyruvic acid is completely oxidized into CO_2 and H_2O . Maximum amount of energy is released by this process. It is also called as citric acid cycle, tricarboxylic acid cycle and Krebs's cycle.

Acetyl co-enzyme is the intermediate product which links glycolysis and Krebs's cycle. During the oxidative phosphorylation 38 ATP molecule are formed out of which 8 ATP molecules are utilized for the process. The net gain is 30 ATP molecule.



Q.6 Define plant growth hormones and classify it. Write in detail about physiological role of Auxins in plant.

Ans :- Hormones: It is a chemical in small amount produced at remote place in plants and promote, inhibit or otherwise modify any physiological processes.

Classified as: Auxins, Gibberellins, Cytokinins and ethylene

Auxins :-

1. Auxins induce elongation of plant cells, roots, buds, stems, petiole, midrib and major lateral veins of leaf.
2. Auxin is responsible for apical dominance. Apical dominance is a process in which apical bud dominates in growth and it does not allow the growth of lateral buds.
3. Some of the auxin derivatives stimulates seeds germination.
4. Some auxins promote cambial activity.
5. Root formation is stimulated by some auxins.

Q.7 Define transpiration? What are the types of transpiration. Enlist the factors that affect rate of transpiration.

Ans :- Transpiration: The loss of water in the form of vapours from the living tissue of aerial parts of the plant is termed as transpiration.

Types of Transpiration

1. Stomatal Transpiration :- Water loss through stomata is called stomatal transpiration.
2. Cuticular Transpiration :- It takes place from the cuticle of the leaves and young stems.
3. Lenticular transpiration :- It takes place through the lenticells (a pore in the cork or woody tissues) of fruit and woody stem.

Factors affecting transpiration :- Light, Temperature, Humidity, Wind, Available soil water, Atmospheric pressure, Structural features

Q.8 Distinguish between the following (Any two)

a) i) Osmosis and diffusion

Osmosis

- 1) It is movement water or solvent from the solution of low concentration to high concentration through a semi permeable membrane.
- 2) In osmosis the movement of solute (solid) never occurs.
- 3) Eg. Absorption of soil water by plants.

Diffusion

- 1) It is movement of molecule of substance in solid, liquid or gas from higher concentration to lower concentration.
- 2) In diffusion movement of solid, liquid or gas takes place.
- 3) Eg. Fragrance of flowers.

b) ii) C_3 and C_4 Plant

C_3 Plant

- 1) C_3 Plants have calvin cycle in all the green cells of leaf
- 2) There is only one CO_2 acceptor, ribulose 1-5 diphosphate which occurs in all the green cells of the plant.
- 3) Carboxylation is catalysed by ribulose diphosphate carboxylase.

C_4 Plant

1. C_4 Plants have Hatch - Slack cycle in the mesophyll cells and calvin-cycles in the cells of the bundle sheath.
2. There are 2- CO_2 acceptors phosphoenol pyruvate in the mesophyll and ribulose 1-5-diphosphate in the cells of bundle sheath.
3. Carboxylation is catalysed by both Phosphoenol pyruvate carboxylase in mesophyll and ribulose diphosphate

c) iii) Active absorption and passive absorption

Active absorption

- 1) It is physiological process
- 2) It involves expenditure of energy on the part of absorbing cells
- 3) It takes place against concentration gradient

Passive absorption

- 1) It is physical process.
- 2) It does not involve expenditure of energy on the part of absorbing cells
- 3) It takes place along concentration gradient

Q. 9 Enlist the criteria for essentiality of nutrient elements and write in short deficiency symptoms and function of following elements in the plants.

a) i) Nitrogen b) ii) Copper

Ans :- According to Arnon (1939) an essential element should possess the following criteria.

- 1) The essential element is indispensable for normal growth of the plants. When the plant is deprived of this element normal growth is affected.
- 2) The essential element cannot be substituted by another element.
- 3) The essential element participates in a bio-chemical reactions of the plant.
- 4) The essential element produces deficiency symptoms when it is not given to the plant.
- 5) The essential element is a part of the organic molecule.

Nitrogen :-

Function

- 1) It is an important constituent of proteins, nucleic acids, prophyirins, alkaloids. Some vitamins, co-enzymes, etc.
- 2) It plays an important role in photosynthesis, protein synthesis, respiration, growth and in almost all the metabolic reactions.

Deficiency Symptoms :-

- 1) Inhibition of cell division and cell enlargement.
- 2) Causes yellowing, i.e. chlorosis of leaves.
- 3) Respiratory rate is affected.

Copper :-

Function

- 1) Copper is a component of plastocyanin and therefore, act as a key role in the electron transport chain in photosynthesis.
- 2) It acts as an activator of several enzymes such as polyphenol oxidase, lactase and oxidase.
- 3) It is a component of enzyme involved in the synthesis of ascorbic acid.

Deficiency Symptoms :-

- 1) Necrosis of the tips of young leaves takes place and then of the margins. The leaves become withered and fall down.
- 2) Exanthema disease takes place in fruit trees. In this disease, gum exudes, characteristic spots are formed on the leaves and fruits.

Q. 10 Write short notes on the following. (Any Two)

- a) Hydroponics b) Photorespiration c) Source - sink relationship

Ans:-

a) **Hydroponics** :- The practices of growing plants in nutrient enriched water without soil is called soil less growth or hydroponics. The search for essential elements of plants has required development of techniques for growing plants in pure salt solutions in the absence of soil. In place of soil, a pure sand, gravel or simple salt solution has been used. Some vegetables and ornamental plants like tomato, carrot, and roses are grown in large shallow tanks which are full of nutrient solution. The tanks are covered with wire netting for the support of the plants. Such cultures are commonly called as soilless growth, tank farming or Hydroponics.

b) **Photorespiration** :- Release of CO₂ in presence of light in respiration process called as photorespiration. In photorespiration temperature plays a very vital role, its rate being very high in between 25 to 35°C. the process also depends upon concentration of oxygen even upto 100%. In photorespiration photorspiring substrate is glycolic acid. The rate of photorespiration is 3 to 5 times higher than respiration.

c) **Source - Sink relationship** :- Activity of photosynthesizing leaves are considered to be the source while all other organs utilizing carbohydrates are regarded as sinks. The carbohydrates are transported from source to the nearest sink. Upper leaves on a plant, export principally to the shoot apex, while lower leaves to the roots and middle leaves to the both. The translocation of sugars from source to sinks takes place through sieve tubes of the phloem.

SECTION 'B'.

Q.11 Fill in the blanks.

- 1) Light reaction of Photosynthesis take place in chloroplast
- 2) End product of glycolysis is Pyruvic acid .
- 3) The breakdown of water molecule into H^+ ions and OH^- ions in the presence of light is called as photolysis
- 4) Ethylene is a fruit ripening hormone

Q. 12 Spell out the abbreviations. Give full form of the following.

- 1) CAM :Crassulacean acid metabolism
- 2) DPD : Diffusion pressure deficit
- 3) PGA: Phosphoglyceric acid
- 4) CCC: Cycocel
