BOT - 121

Crop physiology

Q.1 Define the term crop physiology. Give scope and importance of crop physiology.

→ **Crop physiology** - The systematic application of knowledge of natural process occuring in crop plant & fundamental principle of plant physiology for efficient crop production.

Scope-

1. To study, analyze, invent, investigate, interprete all the life process of plant.
2. To study the effect of various factor upon these life process.
3. To study the function of tissue & plant organ
4. The knowledge can be used enhancing crop improvement & increase crop production.

Importance-

1. Use knowledge of plant nutrition
2. knowledge of the deficiency
3. Use of knowledge of plant water relations
4. Use of growth principles
5. Use of phytohormones
6. Use of growth retardant
7. Manipulating plant response using information technology
8. Increased role of plant.
9. Tissue culture as a recent technique.

Q.2 What is photoperiodism? Explain the classification of plants on the basis of photoperiodism.

→ photoperiodism- The response of a plant in growth and development to the duration of day & night length is called photoperiodism.

classification-

1. Short day plant - A plant which requires less than 12 hours of day length for the initiation of blowering is called short day plant. It is also called as long night plant.
e.g. rice, coffee.

2. Long day plant - A plant which require more than 12 hours of day length for the initiation of blowering is called long day plant. It is also called short night plant.
e.g. Pea, Radish.

3. Day neutral plant - Day neutral plant produce blowers on their own accord with responding to the length of day and night.

Q.3 Define photosynthesis - Explain factor affecting photosynthesis.

→ photosynthesis - The process in which certain carbohydrates are synthesized from CO_2 & water by chlorophyllus cell in the absence of light is called photosynthesis

Factor affecting photosynthesis -

A) External factor -

1. Light
2. Carbohydrates
3. Temp.
4. Water
5. Oxygen
6. Mineral element.

B) Internal factor -

1. Chlorophyll
2. photoplasmic factor
3. Leaf
4. photohormone
5. Accumulation of carbohydrates

Light - It is the main ~~source~~ factor of photosynthesis. The main source of light for photosynthesis is sunlight. Moonlight is effective in marine algae.

Q.4 What is transpiration ? Give significance of transpiration.

→ Transpiration - The loss of water in the form of vapour from the living tissues of aerial parts of the plant.

Significance -

1. It regulate the temp. of the plant & it helps in distribution & translocation of mineral salt with the help of water.

2. If there is no transpiration, there is no absorbtion of water because absorbtion & transpiration is near about equal.

3. Few quality of water is utilized for metabolic activity of plant.

4. Due to absorbtion of water, plant can maintain their turgidity & temp.

5. If the transpiration is more and absorption is less wilting take place in plant is called necessary evil.

Q.5 Define respiration. Give the significance.

→ Respiration- It is the process of biological oxidation were oxygen is utilized & CO_2 is released for the purpose of releasing energy.

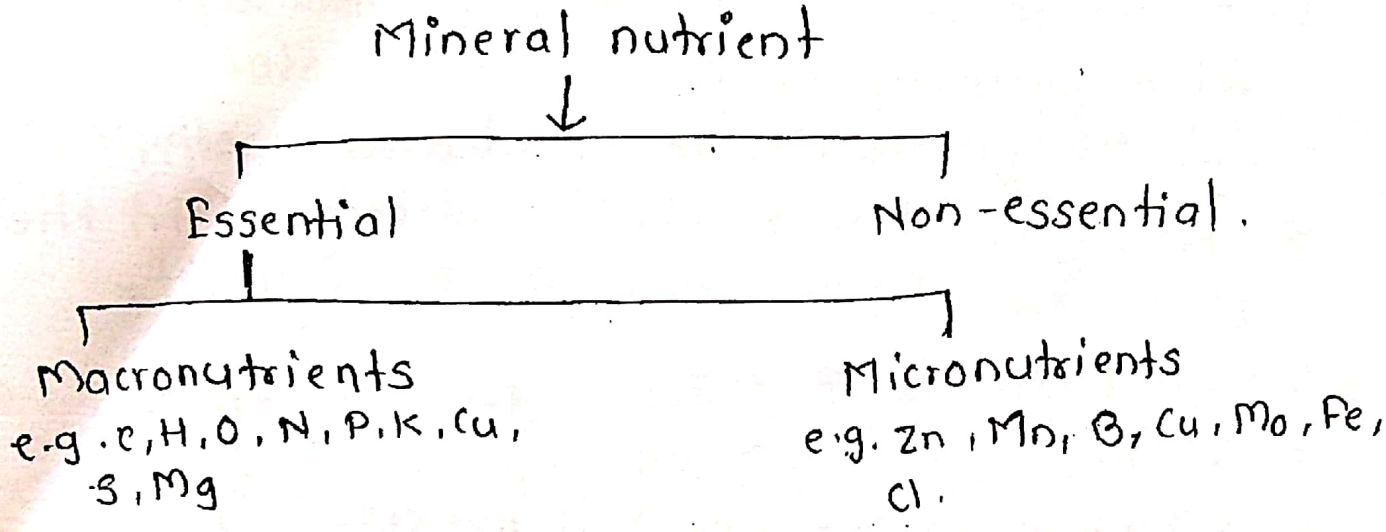
Significance-

1. It release energy which is consumed in various metabolic process essential for plant life.
2. It brings about the formation of other necessary compound participating as important cell constituents.
3. It converts insoluble food into soluble form.
4. It librates carbon di oxide & plays a part actively in maintaining the balance of carbon cycle in nature.
5. It convert stored energy into usable form.

Define mineral nutrition. Give the classification of plant mineral nutrients & give biochemical function N & P.

→ Mineral nutrition – The absorption & utilization of minerals by the plant

Classification –



Nitrogen –

1. The amount of nitrogen present in the whole plant is 1 to 3%.
2. Nitrogen present in the soil in the form of nitrate.
3. It plays important role in photosynthesis, protein synthesis, respiration, growth
4. Respiratory rate is affected.

phosphorus –

1. The amount of phosphorus in the plant is 0.05-1%
2. It plays a key role in energy metabolism.
3. The plants absorb phosphorus in the form of soluble phosphate.
4. Root & shoot become short & slender.

Q.7 Define fruit ripening. Describe the hormonal regulation of fruit ripening.

→ Fruit ripening – It is the physiological process by which a mature fruit is made ready to eating.

Hormonal regulation –

1. Ethylene is an important hormone concerned with fruit ripening.
2. Fruits fail to ripe in the absence of ethylene.
3. When ethylene content is decreased in the fruit, ripening is delayed.
4. Ethylene is a gas
5. It is a plant hormone
6. Ethylene brings about climacteric in fleshy fruits.
7. Ethylene increases permeability of cell.
8. This leads to the softening of the fruits.
9. This enzyme catalyze metabolic reaction.
10. High temperature (35°c) inhibits ethylene production in fruits.

Q.8 Define seniescense. describe classification and significance of senescense.

→ Senescense – The period beth reproductive maturity & depth of a plant or a plant parts

Types – 1. Whole plant senescense
2. Sequencial senescense
3. Shoot senescense
4. Simultaneous senescense

Significance :-

1. Senescence can have certain biological advantages to the sepecies by providing change for reutilization.
2. The whole plant's senscence help to overcome environmental limitation such as water stress, temp, extremes.
3. The process of senscense arises on consequence of natural selection during evolution & its imp as survival factor.

Q.10 Define growth. ~~des~~ enlist different method and explain Arc auxanometer.

→ Growth :- A permantant & irreversible change in size or volume of living structure with increase in dry weight.

Method :-

1. Direct method
2. Horizontal microscope
3. Auxanometer
4. Arc auxanometer
5. Pfeffer's auxanometer
6. Bose's cresograph
7. Space marker disc

Arc Auxanometer-

It consist of vertical stand with pully connected to a pointer on an arc scale. A thread can be passed over the pully

with one end tied to growing point of plant & other to weight. Pully moves resulting in movement of pointer to indicate the rate of growth on the arc scale.

$$x = \frac{\text{length of pointer} \times 2}{\text{Diameter of pully}}$$

$$\text{Growth} = \frac{\text{Distance travelled by indicator}}{x}$$

Q.11 Define ascent of sap. Enlist diff. theories of ascent of sap & brief about the most acceptable theory.

→ Ascent of sap- The movement of water from root to the top most parts of the plant & it's upward movements of water.

Theories-

1. Relay pump theory
2. Pulsation theory
3. Root pressure theory
4. physical force theory
5. imbition theory
6. capillary force theory
7. cohesion & Adhesion theory.

Acceptable theory -

* Cohesion & Adhesion theory -

- The concept of theory is given by Dixon & Jolly (1894). This theory is most acceptable theory.

i) Adhesion & cohesive property of water molecules to form a continuous water alum in the xylum.

ii) strong cohesive force.

iii) Transpiration pull exterted on water.

Q.12 Write diff. betn C_3 plant & C_4 plant.

C_3 plant	C_4 plant.
1. C_3 plant have calvin cycle in all the green cells of leaf.	1. C_4 plant have hatch-stack-cycle in the meso-phyll cell.
2. Carboxylation is total used by ribose diphosphat	2. Both in the mesophyll
3. photorespiration is present.	3. Absent.
4. Calvin cycle found in all photosynthetic plants.	4. C_4 cycle is found only in certain tropical plants
5. The efficiency of CO_2 is less efficiency.	5. More efficieate.
6. First stable productis phosphoglyceric acid.	6. Oxaloacetate is the first stable product.
7. In each every chlorop-last two pigment system is preset.	7. Shedn cells, photostem is absent.

Q.13 Define water use efficiency (WUE) and explain the factor affecting WUE.

→ WUE - The total amount of dry matter production per unit of water loss.

WUE = $\frac{\text{photosynthesis}}{\text{Transpiration}}$.

Factor –

1. Seepage & percolation
2. Soil depth & texture
3. Evoporation & evapotraspiration
4. Weakness in managment-
5. climate pattern
6. Effective rainfall.

* Soil depth & texture – can make a significan difference in efficiency level.

* Evoporation & evopotranspiration – Losses are associated with open cannels, irrigation field and crop growth. The system have successfully prevented losses from both seepage & evoporation.

Q.14 Explain reaction with kreb cycle with diagram.

→ kreb cycle –

- kreb cycle is also known as tricarboxylic acid cycle (TCA)
- kreb cycle starts with condensation of acetyl group with oxaloacetic acid (OAA) and water to yield citric acid.
- kreb cycle is followed in two successive steps of decarboxylation which leading to formation of α-ketoglutalic acid and

state arnon criteria essentiality of nutrient function of deficiency symptom N, P, K

→ Arnon criteria -

1. The deficiency of element makes it responsible for a plant to complete its vegetative & reproductive growth.
2. It can be replaced by any other element.
3. The element has some role in plant metabolism

* classification of mineral element -

1. Primary nutrient - N, P, K
2. secondary nutrient - Ca, mg & sulphur
3. Micronutrient - Fe, Mn, Cu, Zn, Mo, B, Cl.

Function -

1. Nitrogen

& - It is an essential constituent of proteins.
- It is constituent of nucleic acid & many other organic molecules.
- Thus proteins synthesis role of nucleic acid & chlorophyll synthesis are related to nitrogen.

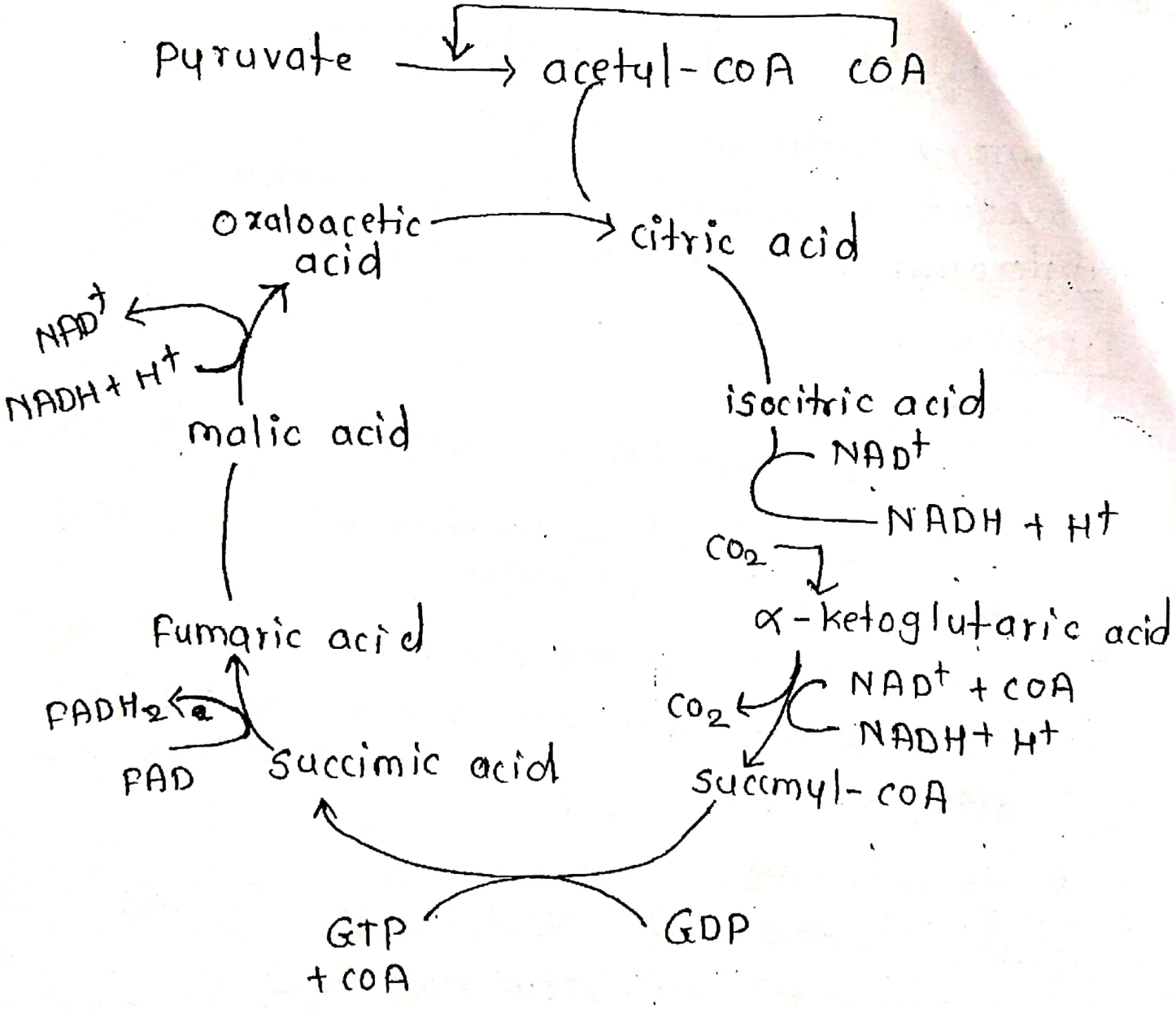
2. phosphorus -

- It is abundantly found in fruit & seeds
- It promotes healthy root growth
- It plays important role in energy transfer reaction.

Succinyl saccinyl co-A is oxidised to OAA allowing the cycle to continuous. The summary equation for this phase of respir. -ation may be written as follows.

- Pyruvic acid 4NAD FAD $2H_2O$ ADP P_i
- Mitochondral matric $3CO_2$ 4NADH 4H $FADH_2$ ATP.

Diagram-



Krebs cycle

Q.16 Write short note on

1: photorespiration -

→ The consumption of O_2 and liberate of CO_2 in presence of light is called photorespiration.

Enzymes involved -

1. RUBP - Oxygenase
2. Phosphatase
3. Glycolic acid oxidase
4. Catalase
5. L - Glutamate glyozylate
6. Glycorate kinase.

Mechanism =

1. Phosphatase
2. Glycolic
3. Catalase
4. Serine.

2. Vernalisation

→ The methods of including early flowering in plants by pretreatment of the seeds at low temp is called vernalisation.

Theory -

1. Thermo stage -
   - This stage is the first & necessory stage & also known as lysenco stage.
   - The low temp range from 0°c - 20°c require for plant species.

2. photo ~~g~~ stage.

- After thermo stage the plant through photo stage.
- This phenomenon is known as photoperio-ism.

3. Third stage

- The stage is associated with seed formatio & development.
- The photoperiod required for this stage.

3. climatic & non-climatic fruit.

→ climatic fruit- All fruits that ripen in response to ethylene exhabit a characteristic respiratory ~~d~~rice befor the ripenning phase called climatic fruit.
e.g. Apple, Banana, mango.

Non-climatic fruit- In constrast fruit such as citrus fruits & grapes do not exhibit the respiration to ethylene production rice are called non-climatic fruit.
e.g. Beltpaper, cherry, citrus, Grape, Pineapple, Strawberry.

Q.17 Define plant harmone. enlist their types & physiological role of auxins & cytokynin.

→ Plant harmone- Harmones are such organic substonce which are produced generally in meristematic tissue of plant & translocated towards site of action including a physiological process.

Types –

1. Auxin
2. Gibberelline } Growth promoter
3. Cytokinins
4. Abscisic acid } Growth inhibitor
5. Ethylene

Auxin –

Apical meristem & young leaves are primary site of auxin synthesis.

physiological role –

1. cell elongation
2. Root initiation
3. Apical dominance
4. Callus formation
5. Respiration.

Cytokinin –

Root are principle site of cytokinin production.

physiological role –

1. cell division
2. Regulate shoot root ratio
3. Delay senesence
4. Cell enlargement
5. Apical dominance
6. chloroplast development.

P.18 Define the following.

1. Abscission

→ Fall of leaves, flower & fruit.

2. Vernalisation

→ Treatment of seed with low temp to shorten the maturity period.

3. Plasmolysis

→ Shrinkage of protoplasm away from its cell wall when the cell is placed in hypertonic solution

4. Hydroponics

→ The art of growing plant in nutritional soln without soil.

5. Glycolysis

→ Anaerobic breakdown of glucose into pyruvic acid.

6. Apical dominance

→ The influence of apical ~~cell~~ bud in supressing the growth of lateral buds.

7. Field capacity

→ The amount of ~~soil~~ water held in the soil against gravity.

8. Guttation

→ Loss of water in the form of water drops through hydathode.

9. Quantasome

→ Quanta of light absorbed by a group of chlorophylls to utilize one molecule of CO_2 & relase one molecule O_2.

10. Osmosis

→ The movement of water molecules through a semipermeable membrane from a soln of lower salt concentration of soln of higher salt conc.

11. ~~Heterosporics~~ Harvest index.

→ The proportion of biological yield represented by economic yield.

12. RGR (Relative growth rate)

→ The increase plant material as produced newly & is added to the capital growth & is expressed as g/g) unit time.

13. CGR (crop growth rate)

→ The dry matter accumulation rate per unit of land area is referred to as CGR.

14. NAR (Net Assimilation Rate).

→ The dry matter accumulation per unit of leaf area is termed as NAR.