

Chapter-6 Plant Growth and Development

1. Define plasticity. Give an example?

A: The ability of the plants to follow different pathways in response to the environment or phases of life to form different kinds of structures is called plasticity.

E.g. Development of heterophylly in response to environment in larkspur(*Delphinium*).

2. What is the disease that formed the basis for the identification of gibberellins in plants?

Name the causative fungus of the disease?

A: 'Bakane' or 'Foolish seedling' disease of paddy.

Gibberella fujikuroi

3. What is the apical dominance? Name the growth hormone that causes it?

A: Inhibition of growth of lateral buds by the apical bud is called apical dominance.

Auxins.

4. What is meant by bolting? Which hormone causes bolting?

A: Sudden and rapid increase in the length of shoot before flowering is called as 'bolting'.

Gibberellins.

5. Define respiratory climactic. Name the PGR associated with it?

A: Rise in the rate of respiration during ripening of fruits is called climacteric.

Ethylene.

6. What is ethephon? Write its role in agricultural practices?

A: 'Ethephon' is a chemical (2-chloroethyl phosphonic acid) used as a source of ethylene.

It is used in artificial ripening of fruits or to hasten the ripening of fruits in agriculture.

7. Which of the PGRs is called stress hormone and why?

A: Abscisic acid is called as stress hormone as it is released during water stress or other kinds of stresses experienced by the plant. During water stress it closes the stomata.

8. What do you understand by vernalization? Write its significance?

A: Dependence of plants on exposure to low temperatures for flowering either qualitatively or quantitatively is called vernalization. In crop plants with winter and spring varieties winter varieties can be made to flower by exposing to low temperatures.

9. Define the terms quiescence and dormancy?

A: Quiescence is the condition of a seed when it is unable to germinate only because favourable external conditions normally required for growth are not present.

Dormancy is the condition of the seed when it fails to germinate because of internal conditions even though external conditions are suitable.

Short Answers Questions

1. Write a note on agricultural/ horticultural applications of auxins.

Ans: Auxins have been used extensively in agricultural and horticultural practices.

- They help to initiate rooting in stem cuttings, an application widely used for plant propagation.
- Auxins promote flowering e.g. in pineapples.
- They help to prevent fruit and leaf drop at early stages but promote the abscission of older mature leaves and fruits.
- Removal of shoot tips (decapitation) usually results in the growth of lateral buds . It is widely applied in tea plantations, hedge-making.
- Auxins also induce parthenocarpy, e.g., in tomatoes.
- They are widely used as herbicides. 2, 4-D, widely used to kill dicotyledonous weeds, does not affect mature monocotyledonous plants. It is used to prepare weed-free lawns by gardeners.
- Auxin also controls xylem differentiation and helps in cell division.

2. Write the physiological responses of gibberellins in plants.

Ans: Gibberellins are another kind of promoter PGR. There are more than 100 gibberellins reported from widely different organisms such as fungi and higher plants.

They are denoted as GA_1 , GA_2 , GA_3 and so on.

They produce a wide range of physiological responses in the plants.

- Their ability to cause an increase in length of axis is used to increase the length of grapes stalks.
- Gibberellins, cause fruits like apple to elongate and improve its shape.
- They also delay senescence. Thus, the fruits can be left on the tree longer so as to extend the market period. GA3 is used to speed up the malting process in brewing industry.
- Sugarcane stores carbohydrate as sugar in their stems. Spraying sugarcane crop with gibberellins increases the length of the stem, thus increasing the yield by as much as 20 tonnes per acre.
- Spraying juvenile conifers with GAs hastens the maturity period, thus leading to early seed production. Gibberellins also promotes bolting (internode elongation just prior to flowering) in beet, cabbages and many plants with rosette habit

3. Write any four physiological effects of cytokinins in plants.

- Ans:
- 1.Cytokinins have specific effects on cytokinesis .
 - 2.It helps to produce new leaves, chloroplasts in leaves, lateral shoot growth and adventitious shoot formation.
 - 3.Cytokinins help overcome the apical dominance.
 - 4.They promote nutrient mobilisation which helps in the delay of leaf senescence

4. What are the physiological processes that are regulated by ethylene in plants?

Ans: The physiological processes that are regulated by ethylene in plants are:

- Influences of ethylene on plants include horizontal growth of seedlings, swelling of the axis and apical hook formation in dicot seedlings.
- Ethylene promotes senescence and abscission of plant organs especially of leaves and flowers.
- Ethylene is highly effective in fruit ripening. It enhances the respiration rate during ripening of the fruits. This rise in rate of respiration is called respiratory climactic.
- Ethylene breaks seed and bud dormancy, initiates germination in peanut seeds, sprouting of potato tubers.

- Ethylene promotes rapid internode/petiole elongation in deep water rice plants. It helps leaves/ upper parts of the shoot to remain above water.
- Ethylene also promotes root growth and root hair formation, thus helping the plants to increase their absorption surface.
- Ethylene is used to initiate flowering and for synchronising fruit-set in pineapples.
- It also induces flowering in mango.
- Ethephon, a source of ethylene, hastens fruit ripening in tomatoes and apples and accelerates abscission in flowers and fruits (thinning of cotton, cherry, walnut).
- It promotes female flowers in cucumbers thereby increasing the yield.

5. Write short notes on seed dormancy.

Ans: Germination of seed requires certain factors like water, oxygen etc. If viable seeds can not germinate even after providing factors for germination the seed is said to be under dormancy. The several reasons for this can be classified into external and internal conditions.

When seed is unable to germinate only because of external conditions normally required for growth are not present it is called Quiescence.

Dormancy is the condition of a seed when it fails to germinate because of internal conditions, even though external conditions are suitable.

Internal factors like immature embryo (e.g. *Ranunculus*), hard seed coat (e.g. Fabaceae), chemicals (seeds of tomato) etc. Hard seed coats can be removed by scarification. Immature embryos need time to mature and germinate.

External factors like temperature, moisture, oxygen, light etc.

Polygonum will not germinate until they have been exposed to low temperatures in moist conditions in the presence of oxygen for several weeks.

Prechilling treatment or stratification is required for certain seeds.

6. Which one of the plant growth regulators would you use if you are asked to

- a) Induce rooting in a twig.**
- b) Quickly ripen a fruit.**
- c) Delay leaf senescence.**
- d) Induce growth in axillary buds.**
- e) 'Bolt' a rosette plant.**

f) Induce immediate stomatal closure in leaves.

g) Overcome apical dominance.

h) Kill dicotyledonous weeds.

- Ans:
- a) Induce rooting in a twig — **Auxins**.
 - b) Quickly ripen a fruit— **Ethylene**.
 - c) Delay leaf senescence — **Gibberellins**.
 - d) Induce growth in axillary buds — **Cytokinins**
 - e) 'Bolt' a rosette plant — **Gibberellins**.
 - f) Induce immediate stomatal closure in leaves — **Abscisic acid**.
 - g) Overcome apical dominance— **Cytokinins**.
 - h) Kill dicotyledonous weeds — **Auxins (2-4 D)**

7. Describe briefly

a) Sigmoid growth curve

b) Absolute and relative growth rates.

- Ans:
- a) **Sigmoid growth curve:** In living organisms growing in a natural environment when a graph is plotted for growth against time a characteristic **Sigmoid curve** results. The growth can be described as geometrical growth. It shows sigmoid shape with initial **Lag phase** followed by **Exponential phase** and finally **Stationary phase**.

Lag phase: The initial growth is slow represented by lag phase.

Exponential phase: Growth increased rapidly thereafter as progeny cells following mitotic division retain the ability to divide. It is also called as **log phase**.

Stationary phase: Later with limited nutrient supply the growth slows down resulting in stationary phase.

b) **Absolute and relative growth rates:** Quantitative comparisons between the growth of living systems can be of two kinds. Measurement and comparison of the total growth per unit time is called as **Absolute Growth Rate (AGR)**.

The growth of the given system per unit time as percentage of initial size is called the **Relative Growth Rate (RGR)**.

$$\text{RGR} = \text{Growth per unit time} \times 100 / \text{Initial size}$$