Chapter-15

PLANT GROWTH AND DEVELOPMENT

POINTS TO REMEMBER

Abscission : Shedding of plant organs like leaves, flowers and fruits etc. from the mature plant.

Apical dominance : Suppression of the growth of lateral buds in presence of apical bud.

Dormancy : A period of suspended activity and growth usually associated with low metabolic rate.

Photoperiodism : Response of plant to the relative length of day and night period to induce flowering.

Phytochrome : A pigment, which control the light dependent developmental process.

Phytohormone : Chemicals secreted by plants in minute quantities which influence the physiological activities.

Senescene : The last phase of growth when metabolic activities decrease.

Vernalisation : A method of promoting flowering by exposing the young plant to low temperature.

Growth : An irreversible permanent increase in size of an organ or its parts or even of an individual.

Abbreviations

IAA	Indole acetic acid
NAA	Naphthalene acetic acid
ABA	Abscissic acid
IBA	Indole-3 butyric acid
2.4D	2.4 dichlorophenoxy acetic acid
PGR	Plant growth regulator

Measurement of growth : Plant growth can be measured by a variety of parameters like increase in fresh weight, dry weight, length, area, volume and cell number.

Phases of growth : The period of growth is generally divided into three phases, namely, meristamatic, elongation and maturation.

(i) Meristematic zone : New cell produced by metotic division at root-tip and shoot tip thereby show increase in size. Cells are rich in protoplasm and nuclei.

(ii) Elongation zone : Zone of elongation lies just behind the meristematic zone and concerned with enlargement of cells.

(iii) Maturation zone : The portion lies proximal to the phase of elongation. The cells of this zone attain their maximum size in terms of wall thickning and protoplasmic modification.

Growth rate : The increased growth per unit time is termed as growth rate. The growth rate shows an increase that may be arithmetic or geometrical.

Growth	Mathematical expression	Curve
In Arithematic growth : Only one daughter cell continues to divide mitotically while other differentiates and matures.	$L_t = L_0 + rt$ L_t = Length at time t L_0 = Length at time zero r = growth rate	Linear curve
In geometrical growth : The initial growth is slow (lag phase) and increase rapidly thereafter at an exponential rate (log phase). • Both the progeny cells divide mitotically and continue to do so. However, with limited nutrient supply, the growth slow down leading to stationary phase.	$W_1 = W_0 e^{rt}$ W_1 = Final size W_0 = Initial size r = growth rate t = time of growth e = base of natural logarithms	Sigmoid or S-curve

Differentiation : A biochemical or morphological change in meristemic cell (at root apex and shoot apex) to differentiate into permanent cell is called differentiation.

Dedifferentiation : The phenomenon of regeneration of permanent tissue to become meristematic is called dedifferentiation.

Redifferentiation : Meristems/tissue are able to produces new cells that once again lose the capacity to divide but mature to perform specific functions.

PHYTO HORMONE OR PLANT GROWTH-REGULATOR

Growth promoting hormones : These are involved in growth promoting activities such as cell division, cell enlargement, flowering, fruiting and seed formation. *e.g.,* Auxin, gibberellins, cytokinins.

Growth inhibitor : Involved in growth inhibiting activities such as dormancy and abscission. *e.g.,* Abscisic acid and Ethylene.

Hormones	Functions
Auxins	Apical dominance, cell elongation, prevent premature leaf and fruit falling, initiate rooting in stem cutting, as weedicide, induce parthenocarpy.
Gibberellins	Delay senescence, speed up malting process, in crease in length of axis (grape stalk), increase in length of stem (sugarcane), bolting in beet, cab bages and many plants with rosette habit.
Cytokinins	Promote cell division, induce cell enlargment, re duce apical dominance, induce growth in auxilary bud, chlorophyll preservation, lateral shoot growth, adventitious root formation.
Ethylene	Promotes senescence and abscission of leaf and fruits, promotes ripening of fruits, break seed and bud dormancy, initiate germina tion in peanut, sprouting of potato tuber, promotes root growth and root hair formation.
Abscisic acid	Inhibit seed germination, stimulate clouser of stomata, increase tolerance to various stress, induce dormancy in seed and bud, promotes ageing of leaf (senescence).

QUESTIONS

Very Short Answer Questions (1 mark each)

1. Write the cause of 'Bakane' disease of rice.

2. Name the plant hormone which was first isolated from human urine.

3. Name the only gaseous plant hormone.

4. How does abscisic acid acts as stress hormone in drought condition ?

5. A farmer observed some broad-leaved weeds in a wheat crop farm. Which plant hormone would you suggest remove them ?

6. Why do lateral buds start developing into branches when apical bud is removed ?

7. Flowering in certain plant occur only when they are exposed to low temperature for a few weeks. Name this phenomenon.

8. Name the hormone released from over-ripe apples that affects all other apples in a small wooden box.

Short Answer Questions-II (2 marks each)

9. How will you induce lateral branching in a plant which normally does not produce them ? Give reason.

10. What induces ethylene formation in plants ? Give any two different action of ethylene on plants.

11. What is meant by abscission ? Name the phytohormone involved in it.

12. What is meant by apical dominance ? Which hormone control it ?

13. Differentiate between photoperiodism and vernalisation.

Short Answer Questions-I (3 marks each)

14. What would be expected to happen if :

(a) GA_3 is applied to rice seedling.

(b) a rotten fruit get mixed with unripe fruits.

(c) you forget to add cytokinin to the culture medium.

15. Which growth hormone is responsible for the following :

(a) induce rooting in a twig

(b) quick ripening of a fruit

(c) delay leaf senescence

(d) 'bolt' a rosette plant

(e) induce immediate stomatal closure in leaves (f) Induce growth in axil lary buds

16. Define differentiation, dedifferentiation and redifferentiation.

17. Where are auxins generally produced in a plant ? Name any one naturally occuring plant auxin and any one synthetic auxin.

18. Define growth rate. Name two types of growth. Give the shape of curve for these growth.

19. Mention various parameter taken into consideration for measuring the growth.

Long Answer Questions (5 marks each)

20. Inlist the five categories of phytohormone. Write atleast two uses of each.

ANSWERS

Very Short Answers (1 mark)

1. Gibberalla fujikuroi.

2. Auxin

3. Ethylene

4. ABA causes rapid closure of stomata, preventing loss of water by transpiration.

5. 2.4-D

6. Due to inhibit activity of Auxin lateral growth starts.

7. Vernalisation

8. Ethylene

Short Answers-II (2 marks)

9. When apical bud is removed, lateral branches are produced. Removal of apical bud effect the auxin is destroyed inducing the lateral buds to grow rapidly.

10. Refer NCERT Book Page no. 250.

11. • Premature fall of leaf and fruit is called abscission.

• Abscisic acid

12. Refer NCERT Book Page no. 250.

13. Refer NCERT Book Page no. 252.

Short Answers-I (3 marks)

14. (a) Hyper elongation of internodes of rice seedlings will occur.

(b) Unripe fruits will lead to early ripening and ultimately it will result in rottening.

(c) Short but formation will not occur.

15. Refer NCERT Book.

16. Refer NCERT Book Page no. 245.

17. Refer NCERT Book Page no. 248.

18. Refer NCERT Book Page no. 242 and 243.

19. Refer NCERT Book Page no. 241.

Long Answers (5 marks)

20. Refer NCERT Book Page no. 247-250.

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