Plant Growth Regulators(NCERT)

Promoters:

1. Auxins:

-first isolated from urine, contains Zinc.
-Natural: Indole Acetic Acid (IAA)
Indole Butyric Acid (IBA)
-Synthetic: Naphthalene Acetic Acid (NAA)
2-4 Diclorophenoxyacetic Acid (2,4D)
-herbicide against dicots.

-observation of Charles/Francis Darwin
-coleoptiles of Canary grass
-curving towards unilateral illumination
-isolated by FW Went
-coleoptiles of oat seedling
-Produced by apices
-cause apical dominance.
-decapitation leads to increase in lateral bud activity
ie: more branches.
(Used in tea plantations, hedge making.)
-Controls xylem differentiation and helps in cell division.

Applications:

1. *Induce parthenocarpy in tomato.*
2. *Promote flowering in pineapples.*
3. *Initiate rooting in stem cuttings.*
   (Plant propagation)
4. *Prevent fruit and leaf drop at early stages.*
5. *Promote abscission of older mature leaves and fruits.*
6. *Used as herbicides against dicot weeds. (2,4 D)*
   (Used to prepare weed free laws as it does not affect mature monocots)
7. *Used in micro-propagation alongside cytokinins.*

2. Gibberellic Acids:

-named after fungi 'Gibberella fujikuroi'.
-causes bakane (foolish seedling) disease in rice.
-seedlings bolt up, then stoop down of their own weight and die.
-reported by E Kurosawa.
("Plants affected even on treating with sterile filtrates, hence presence of soluble chemical.")

-more than 100 known.
-known as GA_1, GA_2, GA_3.....
-GA_3 first discovered and most studied.

-All gibberellins are acidic, but all auxins are not acidic.

-cause increase length of axis.
-cause fruits to elongate.
-delay senescence.
- In juvenile conifers causes early seed production by hastening maturity.
-Bolting in beet, cabbage, and plants with rossette habit.
-Bolting is internodal elongation pre-flowering period.

Applications:
1.Used to increase length:
a. of grape stalks.
b. of fruits, such as apple, to improve shape.
c. sugar cane, to increase yield by 20 tonnes per acre.
d. promoting bolting in above said crops.
2. Delays senescence, fruits can be left on the tree longer.
-to extend market period.
3. GA_3 speeds up the malting process in brewing industry.

3. Cytokinins.

-'Kinetin' term by F. Scoog and Miller.
-Kinetin from autoclaved(heated under pressure) herring(a fish) sperm DNA.
-Tissue culture experiments:
    -by Scoog on tobacco.
    -callus proliferated only on addition of particular extarcts, along with auxins.
    -Some extracts were from vascular tissues, yeasts, DNA or coconut milk.
-Kinetin
    -Modified form of adenine.
    -does not occur naturally in plants.
    -N^6 Furfurylamino purine or N^6 Furfuryladenine
-Zeatin
    -from corn-kernels and coconut milk.
    -produced in areas of rapid cell division:
        -root apices, shoot buds and young fruits.
    -butenol compound of adenine.

-helps overcome apical dominance.
-promote mobilization hence delaying leaf senescence.
-to produce new leaves.
-to produce chloroplast in leaves.
-promotes lateral and adventitious shoot growth.

Applications:
    In tissue culture along with auxins.
    In making anti-aging creams.

Inhibitors:

4. Ethylene/Ethyne

-Discovered by Cousins.

"Volatile substance from ripe oranges hastened ripening of stored unripe bananas."

-synthesized in large amounts by tissues undergoing senescence and ripening fruits.
-most widely used PGR in agriculture.

-senescence and abscission leaves and flowers.
-ripens fruits by enhancing respiration rate.
-ergo known as respiratory climactic.
-horizontal growth of seedlings.
-swelling of axis.
-apical hook formation in dicot seedlings.
-breaks seed dormancy:
-germination of peanut peanut seeds.
-breaks bud dormancy:
-sprouting of potato tuber.
-promotes rapid inter-node/petiole elongation in deep water rice plants:
-helps leaves/upper parts of shoot remain above water.
-promotes root growth and root hair formation.
-helps plant to increase absorption surface.
-used to initiate flowering and for synchronizing fruit set in pineapples.
-induces flowering in mango.
-hastens fruit ripening in tomatoes and apples.
-accelerates abscission in flowers and fruits:
-thinning of cotton, cherry, walnut.
-increases yield in cucumber by increasing number of female flowers.

"Ethephon"
-commercially used for ethylene administration
-aqueous solution is readily absorbed & transported within plant
-releases ethylene slowly.

5. Abscisic Acid

-1960: Inhibitor B, Abscission II, Dormin.
-chemically identical.
-'stress hormone'

-regulates abscission and dormancy
-plant growth inhibitor
-inhibitor of plant metabolism
-inhibits seed germination
-stimulates closure of stomata
-increases tolerance of plants to various stresses
- 'stress hormone'
-important role in seed development, maturation and dormancy.
-prevents desiccation by inducing dormancy.
-works as an antagonist to GA.