SEED GERMINATION

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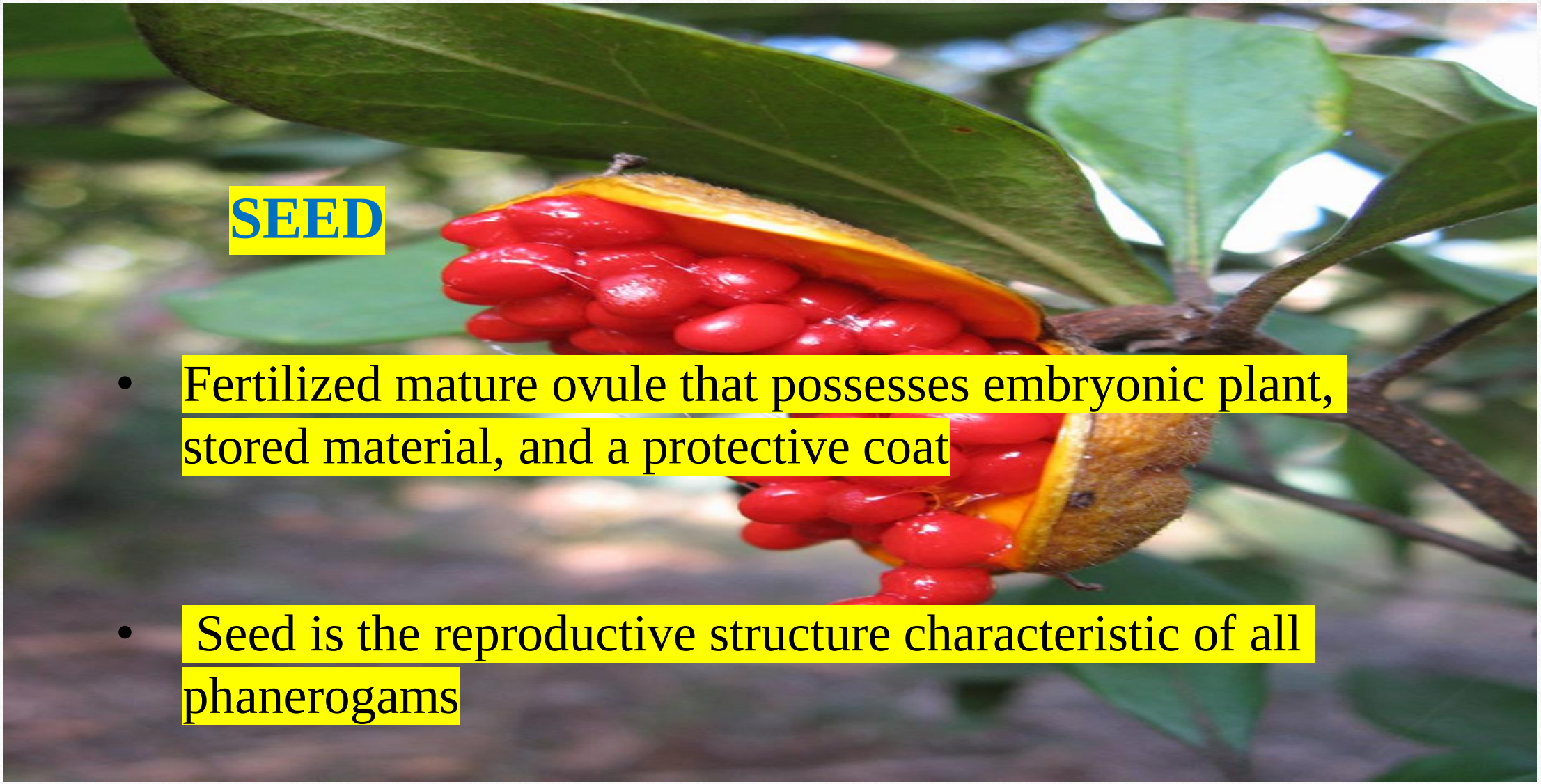


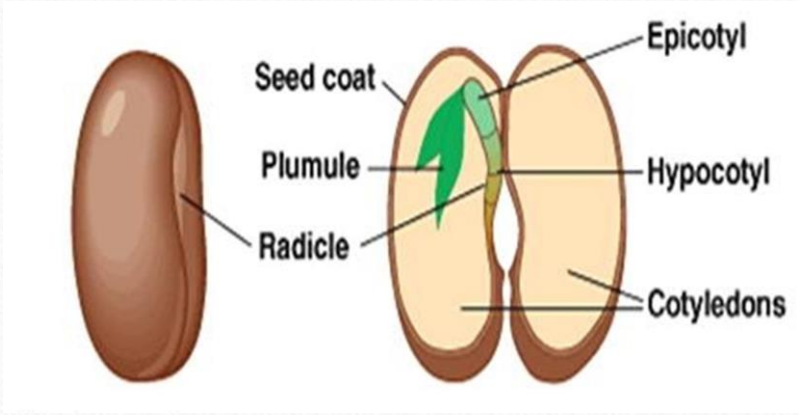
SEED

- Fertilized mature ovule that possesses embryonic plant, stored material, and a protective coat

- Seed is the reproductive structure characteristic of all phanerogams

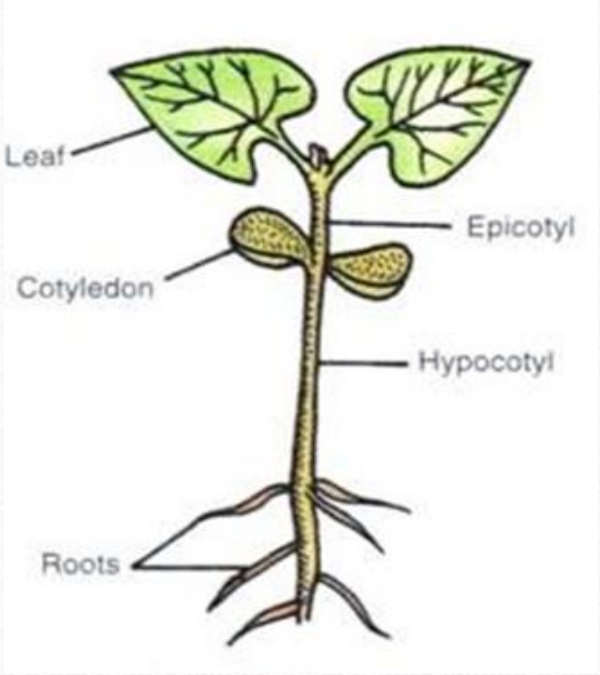
STRUCTURE OF A SEED

- The outer covering of a seed is called seed-coat which is a protective covering and is known as **testa**
- The inner layer below the testa is called **tegmen**
- Seeds contain a small opening called **micropyle** through which water enters into the seed
- Inside, seeds contain embryo which consists of **cotyledons**, **radicle** and **plumule**



- **Epicotyl** - The upper portion of the axis of the seedling above the cotyledons

- **Hypocotyl** - The portion of seedling between the cotyledons and the radicle



GERMINATION

- Germination is a process by which the embryo in the seed becomes activated and begins to grow into a new seedling

THE PROCESS OF SEED GERMINATION

STAGE 1

- Germination begins with the seed's absorption of water
- Most dormant seeds have 5–10% moisture content
- When conditions are right, water is absorbed very rapidly
- Most water is absorbed through the micropyle
- As the cells hydrate, they swell and become turgid or rigid

Continue…..

- The moisture triggers an increase in cellular respiration
- Oxygen must be present for cellular respiration

STAGE 2

❖ Metabolic activity surges

- Proteins are synthesized
- Gibberellins stimulate the production of enzymes

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- The enzyme protease breaks down stored proteins into amino acids
- The sugars and amino acids are directed towards cell division, growth, and differentiation sites at the root and shoot meristems or tips

STAGE 3

- Metabolic processes increase
- The swelling of cells causes the seed coat to rupture

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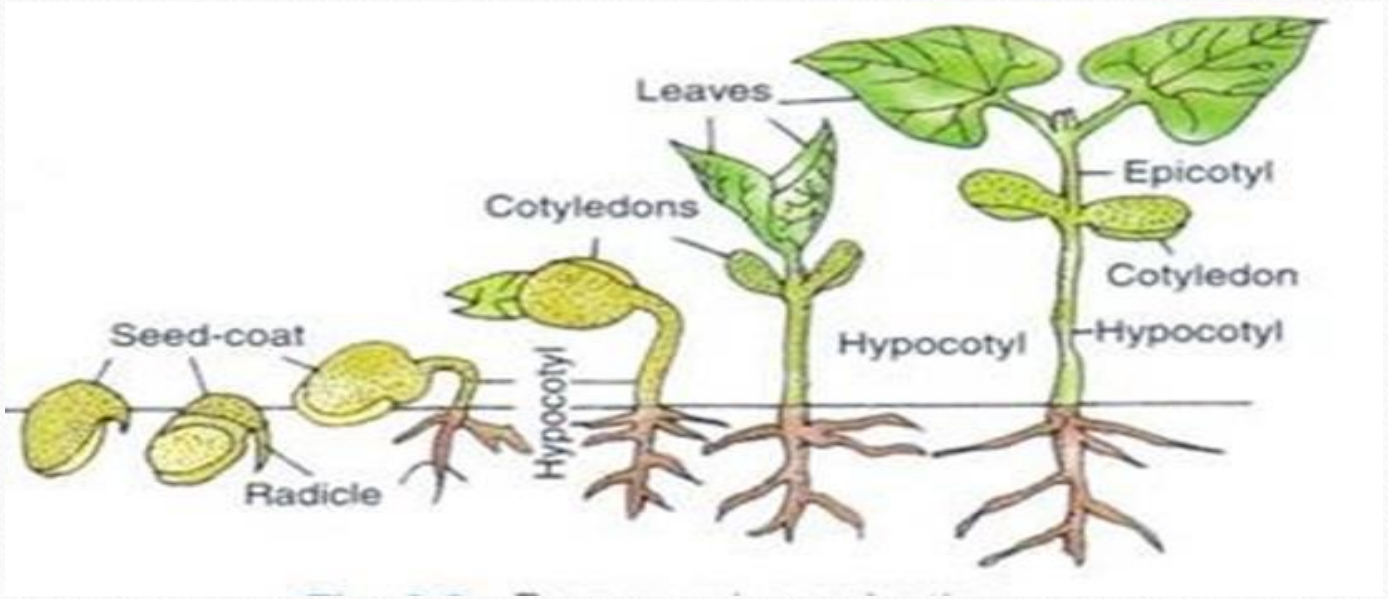
- The primary root or radicle emerges downward, and the stem grows upwards
- The shoot begins manufacturing food through photosynthesis
- The roots absorb water and nutrients

TYPES OF GERMINATION

Epigeal Germination

- In this type of germination, the hypocotyl elongates rapidly and arches upwards pulling the cotyledons which move above the soil

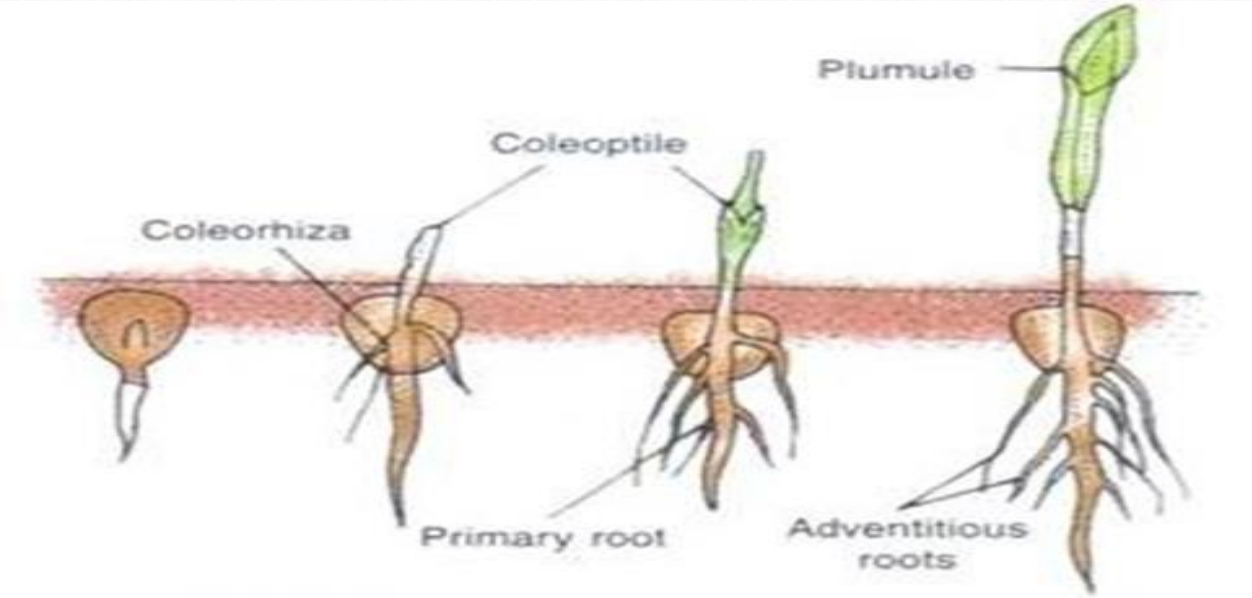
e.g . Bean, cotton, papaya, gourd, castor and onion, etc.



Hypogeal Germination

- In this type of germination, the epicotyl elongates and the cotyledons remain below the soil

- e.g. Pea, mango, maize, rice, gram and groundnut,etc.



CONDITIONS NECESSARY FOR SEED GERMINATION

Water

- Water plays an important role in seed germination
- It helps by providing necessary hydration for the vital activities of protoplasm
- It provides dissolved oxygen for the growing embryo, softens the seed coats and increases the seed permeability
- It also helps in the rupturing of seed and also converts the insoluble food into soluble form for its translocation to the embryo

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Oxygen

- It is an important and essential source of energy required for seed growth
- It is required by the germinating seed for the metabolism
- It is used as a part of aerobic respiration until it manages to grow green leaves of its own

Temperature

- For a seed to germinate, it requires a moderate temperature of around 25-30°C
- Different seeds require different optimum temperatures
- There are some seeds which require special requirements either lower or higher temperature between 5 to 40°C

Light or darkness

- This can act as an environmental trigger

- Many seeds refuse to germinate until sunlight falls on them

The process of seed germination, under favourable conditions, triggers the seed to undergo a rapid expansion growth of the embryo

FACTORS AFFECTING SEED GERMINATION

External Factors

- **Water**: The poor or additional supply of water affects the seed germination
- **Temperature**: This affects the growth rate as well as the metabolism of the seed
- **Oxygen**: Germinating seeds respire vigorously and release the energy required for their growth
- Deficiency of oxygen affects the seed germination

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Internal Factors

Seed Dormancy: This is a condition in which the seeds are prevented from germinating even under favourable conditions

During seed dormancy:

- The seed coat, which is resistant to water and gases, restrict water uptake and oxygen exchange.
- The seeds with undeveloped or immature embryo do not germinate
- Certain seeds contain plant growth regulators which inhibit seed germination

Some seeds require more time for their germination

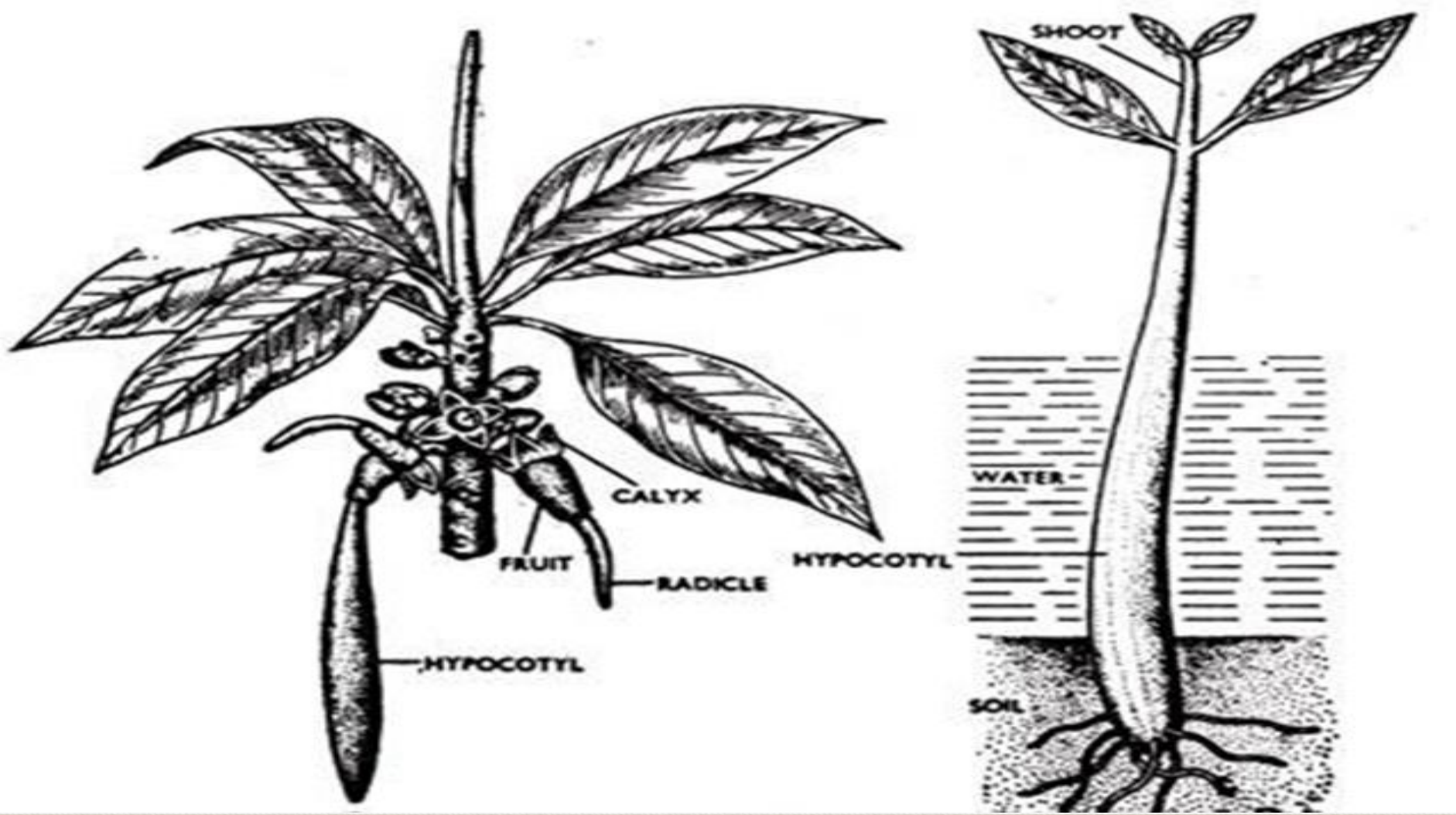
METHODS USED FOR BREAKING SEED DORMANCY

- Scarification
- hot water treatment
- Stratification
- Exposure to white light
- Soaking in water
- Sulphuric acid treatment
- Treatment with chemicals, etc.

VIVIPARY

- Vivipary means germination of the seed within the fruit while still attached to the mother plant
- Viviparous plants the process of germination is slow
  e.g. ***Rhizophora mucronata***, ***Bruguiera gymnorhiza***, etc.
- When the hypocotyl grows very heavy the fruit gets detached from the plant, falls vertically down
- The radicle penetrates the soil below the shallow water
- It soon forms a root system while the plumule grows safely above the water level

VIVIPARY



REFERENCES

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THANK YOU