

Factors Influencing Seed Germination

1. Definition of Seed Germination

- Germination is the process through which a seed begins its transformation into a young plant or seedling.
- It marks the transition from dormancy to active growth.
- Germination occurs only under favorable conditions, such as adequate water, air, and appropriate light or dark conditions.
- These factors stimulate the embryo inside the seed, leading to growth and the emergence of a new plant.

2. Essential Conditions for Seed Germination

Successful seed germination depends on key factors:

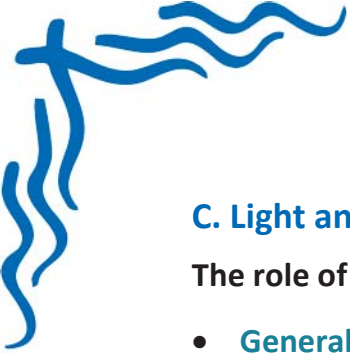
A. Water

Water is the most crucial factor for germination, as it performs multiple roles:

- **Hydration of the Seed Coat:** Softens the tough outer layer of the seed to initiate germination.
- **Activation of Enzymes:** Triggers metabolic processes essential for the embryo's growth.
- **Oxygen Dissolution:** Ensures oxygen is available to the embryo for respiration.

B. Air and Soil

- **Oxygen Requirement:** The seed embryo requires oxygen for respiration and energy production.
- **Air in Soil:** Oxygen is obtained from air pockets trapped in loose, well-aerated soil.
- **Growth Without Soil:**
 - Soil is not mandatory for germination as long as water and oxygen are available.
 - Seeds can germinate on moist surfaces like paper towels or cotton wool.
 - However, soil becomes essential for further growth as it provides nutrients and support.



C. Light and Dark Conditions

The role of light varies depending on the type of seed:

- **General Seeds:** Most seeds do not require light for germination and rely on stored nutrients.
- **Light-Sensitive Seeds:** Some flowering plants, like coleus and petunia, require light exposure to trigger germination.
- **Dark-Requiring Seeds:**
 - Some seeds, such as Calendula and zinnia, require darkness for successful germination.
 - These seeds must be covered with soil to initiate growth.

3. Movement in Response to Stimuli

Seeds and seedlings respond to environmental stimuli for proper growth and development:

A. Gravitropism (Response to Gravity)

- **Upright Position:**
 - Shoots grow upwards toward sunlight.
 - Roots grow downwards for stability and nutrient absorption.
- **Inverted Position:**
 - Shoots adjust to grow upwards.
 - Roots bend downward to align with gravity.

B. Phototropism (Response to Light)

- Shoots grow towards the light to maximize photosynthesis.
- Roots grow downward, unaffected by light direction.

C. Hydrotropism (Response to Water)

- Roots grow towards water sources to absorb moisture efficiently.