

Effect of Temperature on Plant Growth

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Plants are living organisms that respond sensitively to changes in environmental conditions such as temperature, light, and soil nutrition. Scientists continuously conduct experiments on plants to understand their physiology — including color, growth, nutrient uptake, and disease occurrence. This article discusses how temperature variations, both hot and cold, influence the growth and nutrient absorption capacity of plants.

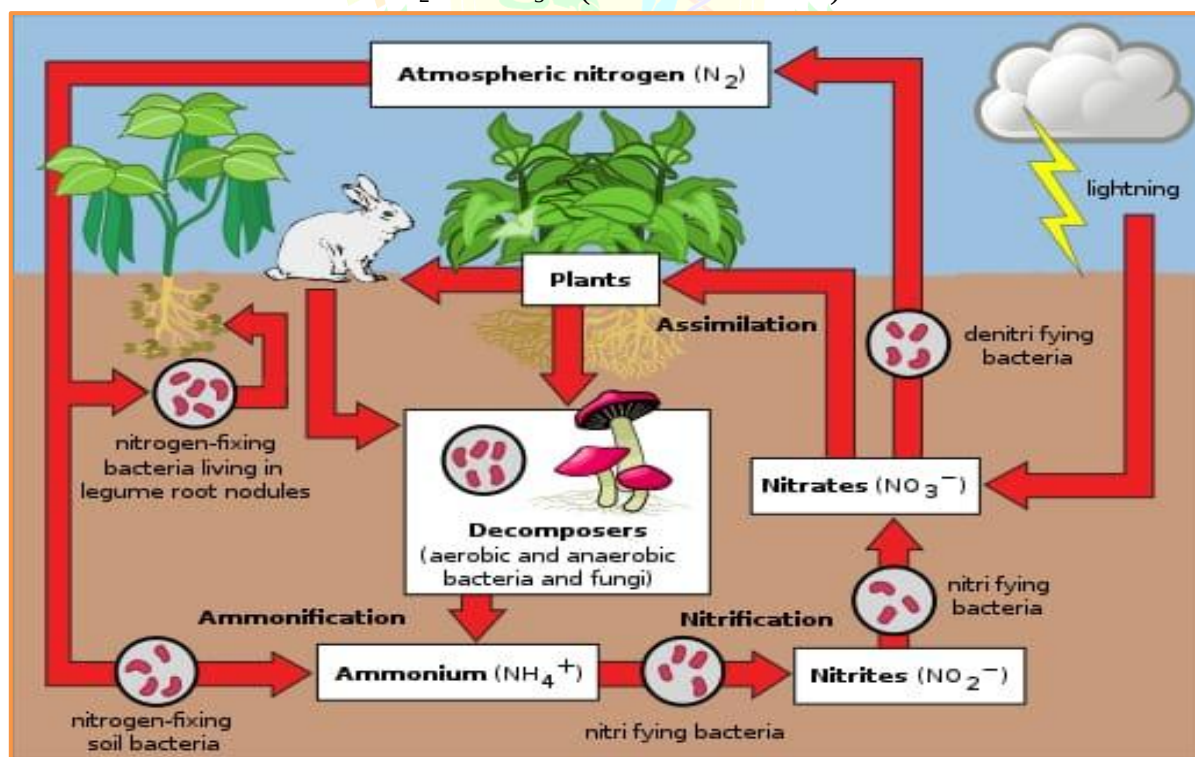
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Introduction

From time to time, numerous experiments are carried out on plants. Through research, we learn why plants are green, how they grow, how diseases affect them, how they absorb nutrients, and how nutrient deficiencies lead to various disorders. We also study the working of plant roots and how temperature fluctuations — heat or cold — affect their overall development. Scientists continue to research these aspects to improve crop productivity and plant health.

Nitrogen and Nutrient Absorption

Plants absorb essential nutrients from the soil and nitrogen from the atmosphere — not directly as nitrogen gas (N_2), but in the nitrate (NO_3^-) form.



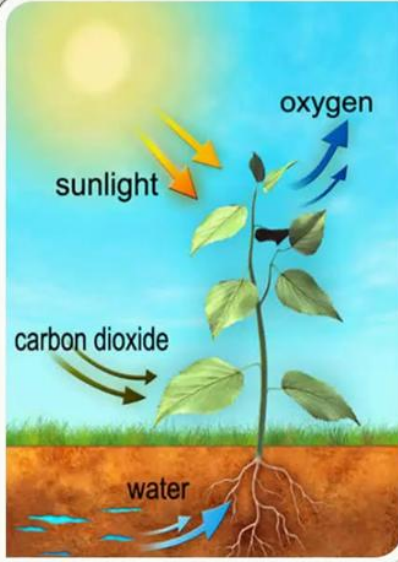
In the atmosphere, specific bacteria convert nitrogen gas into nitrates that plants can absorb. Plants cannot take atmospheric nitrogen directly because the $N \equiv N$ triple bond in nitrogen molecules is extremely strong and requires a high amount of energy to break — much more than what plants can produce. Rhizobium, a symbiotic bacterium, plays a vital role in nitrogen fixation. It is especially significant in leguminous crops, forming nodules in their roots where nitrogen is converted into usable compounds. This process enhances soil fertility and promotes plant growth.

Essential Nutrients

Plants absorb various macronutrients and micronutrients from the soil, including C, H, O, N, P, K, Ca, Mg, S, Fe, Zn, B, Cu, Cl, and Ni. Each element has a specific function in plant metabolism and growth. Deficiency of even a single nutrient can lead to physiological disorders, stunted growth, and reduced yield. In the root system, secondary roots are mainly responsible for absorbing nutrients from the soil, while the primary thick root (taproot) helps anchor the plant firmly. Both xylem and phloem tissues are present within the roots to transport water, minerals, and food.

Photosynthesis

Through the process of photosynthesis, plants capture light energy within the wavelength range of 400–700 nm. This energy is used to convert carbon dioxide and water into glucose and oxygen, providing the primary source of energy for plant growth.



प्रकाश संश्लेषण

✓ प्रकाश संश्लेषण क्रिया में **क्लोरोफिल** मुख्य वर्णक की भाँति जबकि **कैरोटिनाइड्स**, **फाइकोबिलिन्स** सहायक वर्णक की तरह कार्य करते हैं।

✓ प्रकाश-संश्लेषण की क्रिया में चार मुख्य अवयव हैं, जल, कार्बनडाइऑक्साइड, प्रकाश एवं पूर्ण हरित।

रासायनिक समीकरण :-

$$6 \text{CO}_2 + 12 \text{H}_2\text{O} \xrightarrow[\text{क्लोरोफिल}]{\text{सूर्य का प्रकाश}} \text{C}_6\text{H}_{12}\text{O}_6 + 6 \text{O}_2 + 6 \text{H}_2\text{O}$$

कार्बन
डाइ
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जल

ग्लूकोज

ऑक्सी
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During the cold season, the growth rate of plants decreases because the roots lack sufficient metabolic energy compared to the warm season. Cold weather causes the soil to become sticky and compact, making it difficult for roots to absorb nutrients. Plant cells may also suffer damage due to freezing, reducing the plant's ability to take up water and minerals.

Additionally, reduced sunlight during winter further limits photosynthesis. In contrast, under hydroponic systems, if the temperature is maintained between 18°C and 25°C, plants generally grow well. If the temperature drops below this range, the roots may be damaged, leading to nutrient uptake problems. At very high temperatures, plants also suffer heat stress and fail to maintain normal physiological functions. The soil pH must also match the plant type, as pH influences nutrient availability. When two plants depend on each other, nutrient deficiency or stress in one can negatively affect the other, reducing overall growth and energy transfer.

Conclusion

Temperature plays a crucial role in determining plant growth and productivity. Both excessively low and high temperatures can impair root function, nutrient absorption, and photosynthesis. Maintaining an optimal temperature range (18–25°C) and proper soil conditions ensures healthy plant growth and maximum yield.