



BBX11 Gene: Greening of Plants

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Why in News

Recently, the **Indian Institute of Science Education and Research (IISER)** has recognized the **BBX11 gene** that facilitates the greening of crops.

Key Points

- **About BBX11 Gene:**

- The researchers discovered a mechanism where two proteins oppositely regulate the **BBX11** gene to maintain optimum ranges of **BBX11**.
- **BBX11** plays a vital role in regulation of the amount of **protochlorophyllide** synthesized by the plant.
 - **Protochlorophyllide** is an intermediate in the synthesis of chlorophyll.
 - If it is **less**, plants are **unable to efficiently green in order to harvest sunlight** and if the amount of **protochlorophyllide** is more, then **photobleaching occurs**.
 - **Photobleaching** is **loss of colour** by a pigment.
 - The quantity of **protochlorophyllide** synthesised needs to be **proportional** to the **variety of enzymes** available to transform them to chlorophyll.
 - It is very **important to regulate the amount of protochlorophyllide** synthesized by the plant.

- **Synthesis of Chlorophyll:**

- **Chlorophyll is the green pigment in plants, algae, and cyanobacteria that absorbs sunlight and uses its energy to synthesise carbohydrates from Carbon-di-Oxide (CO₂) and water.**

The synthesis of chlorophyll in plants is a **lengthy, multi-step process.**

- When a seedling emerges from under the soil **it must quickly synthesise chlorophyll to start supporting its own growth.**

In order to facilitate quick synthesis of chlorophyll, plants make a precursor of chlorophyll called '**protochlorophyllide**' in the dark, which **glows red in blue light.**

- As soon as the plant comes out into the light from under the soil, light-dependent enzymes convert **protochlorophyllide to chlorophyll.**

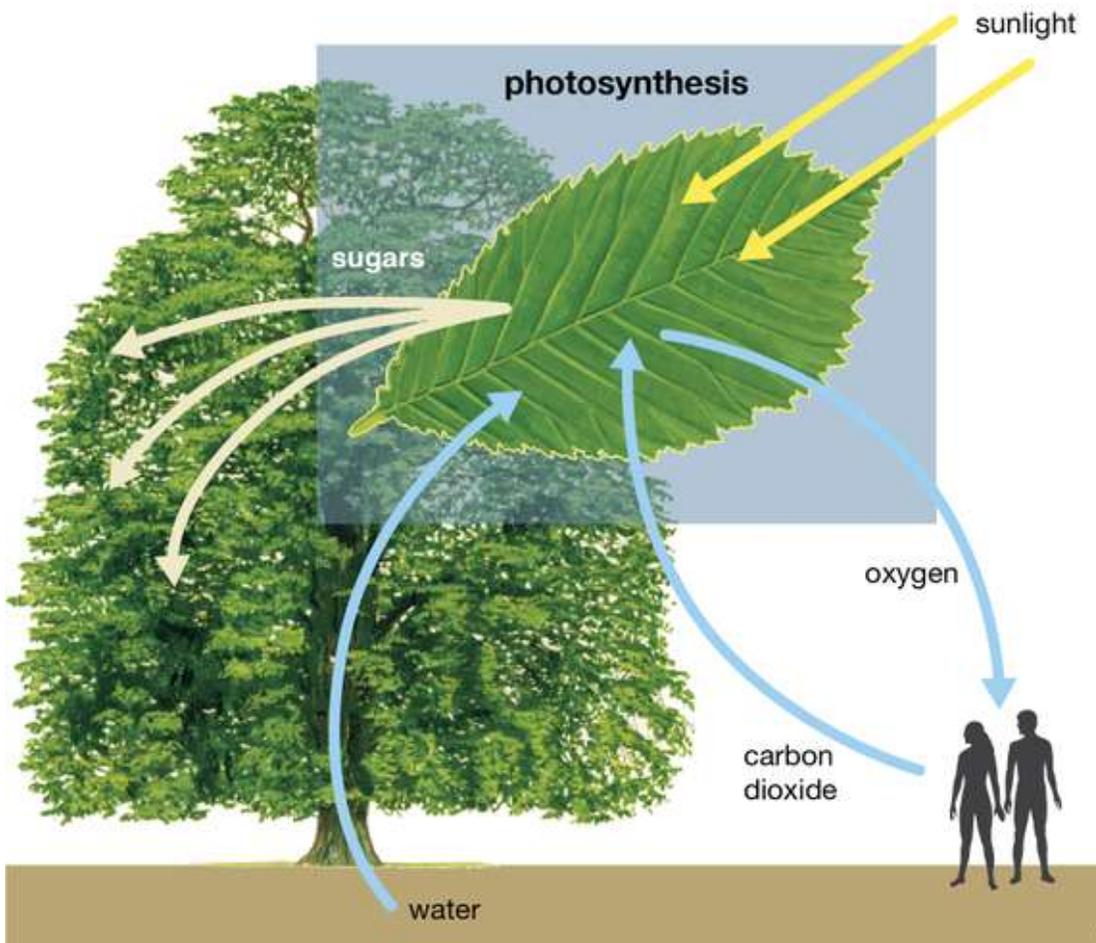
- **Implications:**

- This discovery has **many implications within the agriculture sector in tropical nations like India** and can **assist present results in optimising plant progress** in frequently **changing weather conditions.**

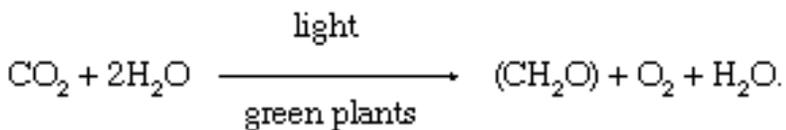
- Due to the quickly altering weather conditions, **farmers in a number of states in India, particularly in Maharashtra, are struggling with large losses in crop yields.**
- This often leads to **severe distress among the farming community as indicated by the high number of farmer suicides** in Maharashtra for the past several years.
- **Major Reasons for Crop Failure:** Severe **drought**, high temperature and high light.

- Young seedlings emerging out of the soil are extremely sensitive to high irradiance of light. This study can **provide leads to optimise plant growth under these stressful conditions.**

Photosynthesis



- Photosynthesis is the process by which **green plants and certain other organisms transform light energy into chemical energy.**
- During photosynthesis in green plants, **light energy is captured and used to convert water, carbon dioxide, and minerals into oxygen and energy-rich organic compounds.**



- **Factors Affecting Photosynthesis:** Photosynthesis is under the influence of several factors, both **internal (plant) and external.**
 - **Internal:** Number, size, age and orientation of leaves, mesophyll cells and chloroplasts, internal CO_2 concentration and the amount of chlorophyll.
 - **External:** Availability of sunlight, temperature, CO_2 concentration and water. For example, despite the presence of a green leaf and optimal light and CO_2 conditions, the plant may not photosynthesise if the temperature is very low.

- **Importance:**

- It would be impossible to overestimate the importance of photosynthesis in the **maintenance of life on Earth.**
- If **photosynthesis ceased**, there would soon be **little food or other organic matter on Earth.**
- **Most organisms would disappear**, and in time **Earth's atmosphere would become nearly devoid of gaseous oxygen.**
- Energy produced by photosynthesis carried out by plants millions of years ago is responsible for the **fossil fuels (i.e., coal, oil, and gas) that power industrial society.**

Source:TH