



**Plantastic Discoveries**

**Plants**  
for the **Future**  
European Technology Platform



# **How do plants respond to droughts?**

**EU Green Week 2024**  
#WaterWiseEU



See  
**Water**  
Differently

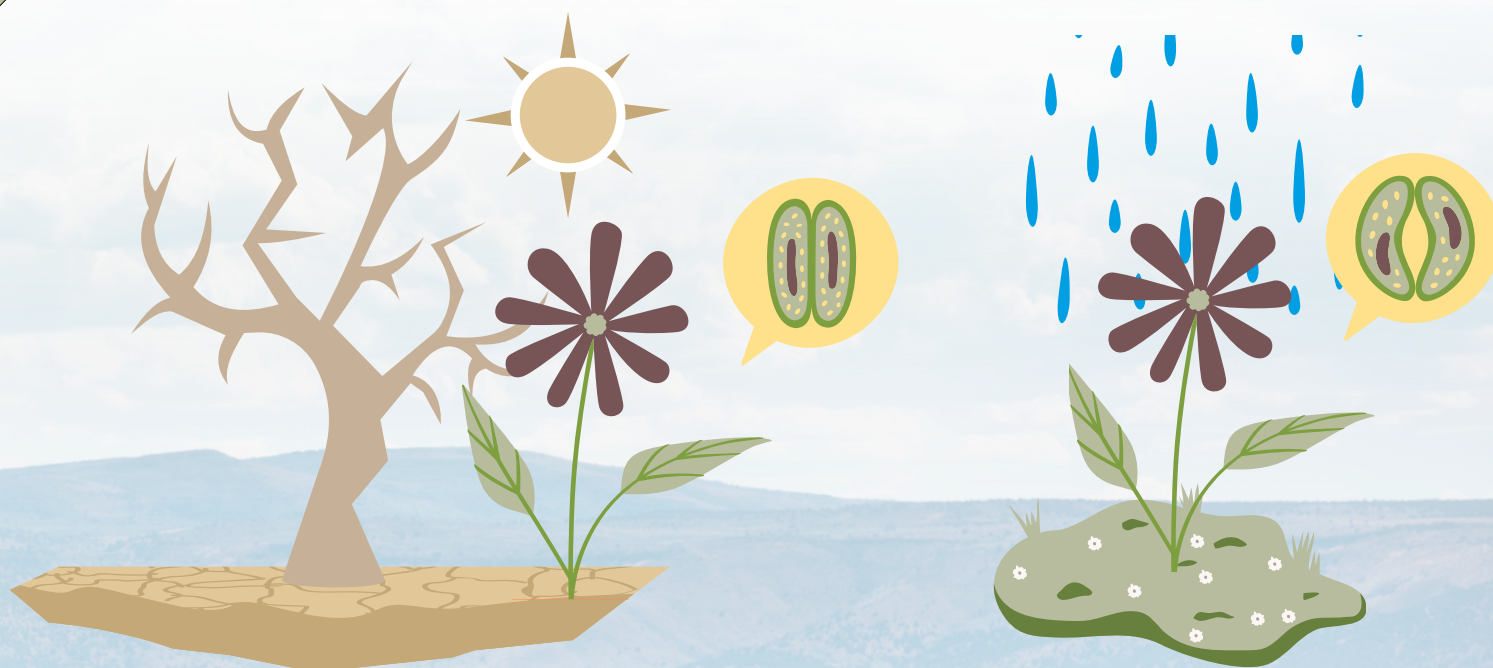
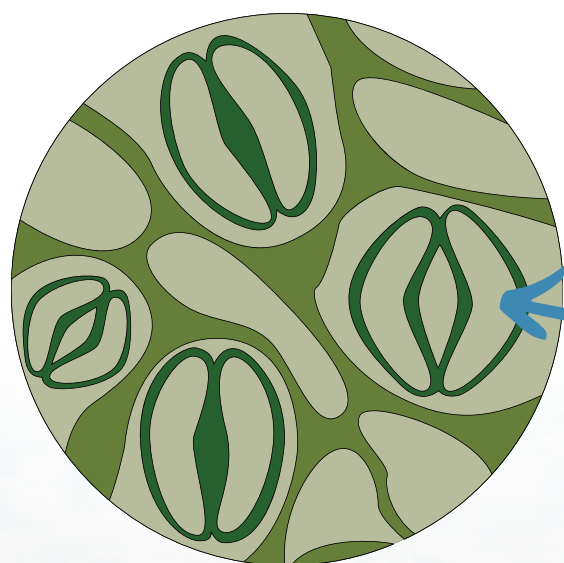
Just as water resilience is vital for sustainable water management, understanding how **plants cope with drought stress** is essential for ensuring **food security** and **ecosystem health**.



**So how do plants respond to a lack of water?**

## Stomatal closure

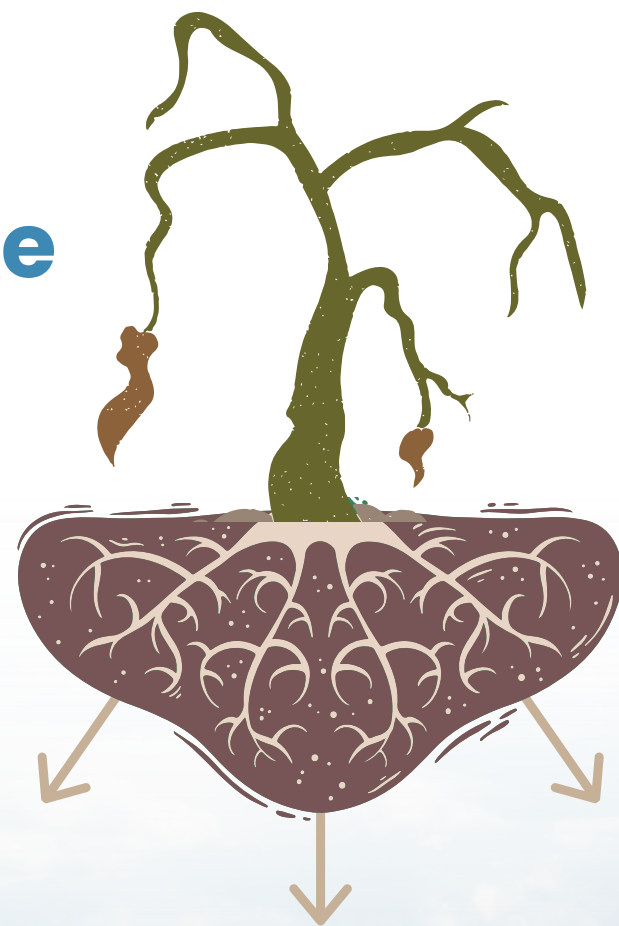
One of the first responses of plants to drought is the closure of stomata, which are tiny pores on the leaves that allow for gas exchange and water loss.



When plants detect water scarcity, they release the hormone abscisic acid, which triggers the closure of stomata, reducing water loss through transpiration.

## Root Growth and Water Uptake

Plants allocate more resources to root growth during drought conditions, allowing them to explore a larger soil volume and access deeper water reserves. They also increase the production of root hairs and modify root architecture to enhance water uptake.



## Osmotic Adjustment

Plants have a clever strategy for dealing with dry conditions. They make osmotic adjustments (balancing water inside and outside their cells) to retain water and stay firm during droughts. This helps them continue growing and thriving. However, if this water balance is disrupted, it can lead to stress and hinder their growth.

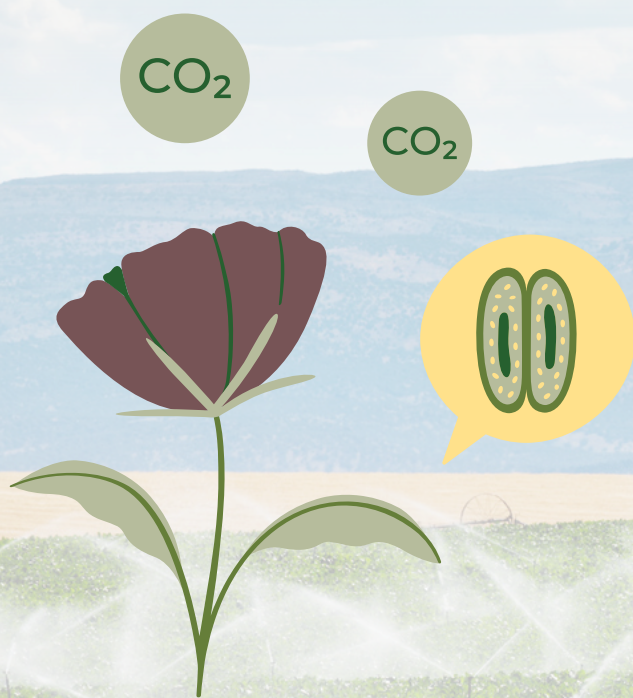
## Leaf Shedding and Wilting

As a drought progresses, plants may shed their leaves to reduce transpirational water loss and conserve resources. Leaves may also wilt, which reduces the surface area exposed to sunlight and further minimises water loss.



## Photosynthesis Reduction

Drought causes stomatal closure to prevent water loss, reducing CO<sub>2</sub> intake for photosynthesis. This can lead to the plant experiencing oxidative stress, which hinders the plant's ability to do photosynthesis and therefore, grow.



## Dormancy and Seed Production

Some plants may enter a dormant state during drought conditions to conserve resources. Alternatively, some plants accelerate seed production to ensure the survival of the next generation.



## Molecular and Genetic Responses

At the molecular level, plants activate various genes and signaling pathways in response to drought stress. For example, genes that produce protective compounds like antioxidants and compatible solutes, which help stabilise the plant's cells and prevent damage from drought.

# Droughts can favour pests

Many plant-feeding insects tend to survive and **thrive better under drought conditions.**

Drought can directly **benefit herbivorous insects** by creating favorable conditions for their growth and development, as well as indirectly by altering plant attractiveness and nutrition, potentially increasing insect feeding. In contrast, **beneficial insects** that usually regulate pests may **face challenges** in hot, dry conditions.

## and reduce the efficiency of pesticides...

During drought, **plants might struggle to take in insecticides effectively**. When plants are stressed from lack of water, they may not absorb and move these insecticides around their system as well as they normally would. As a result, the **insecticides may not spread evenly throughout the plant**. Some parts could end up with too much, while other areas might not get enough, affecting how well the insecticides work.

This uneven spread may lead to **pests developing behavioral resistance**, favoring areas with lower insecticide levels. With climate change increasing drought frequency, systemic insecticides may become less effective, accelerating pest resistance development.