

Plant Diseases and Defences Notes

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Plants just like animals are constantly responding to attack from pathogens and pests. Plants have both chemical and physical defences to protect them against pathogens, pests and damage from grazers.

Physical Defences

Defence	What it does
Thorns and hairs	Thorns and hairs protect the plant by discouraging animals from eating them as they can physically damage or injure the animal.
Bark	Just like skin in humans, bark is an external dead layer which prevents pathogens from entering.
Leaf cuticle	Leaves are covered with waxy cuticle which <u>acts as a physical barrier</u> to prevent their cells from becoming infected. It can be quite thin, such as those of aquatic plants or quite thick such as those on cacti.
Cell wall	Each plant cell has a cellulose cell wall which acts as another physical barrier against infection. It also contains a variety of chemical defences.

Chemical Defences

Defence	What it does
Poisons and toxins	Some plants are capable of producing poisons to prevent animals from eating them. Bamboo, for example, produces cyanide, a deadly poison. Cyanide is highly toxic to most living things.
Antibacterial chemicals	These kill bacterial cells and help to prevent a bacterial infection.
Antifungal chemicals	These kill fungal cells and help to prevent a fungal infection.

Exam note: some of the antibacterial and antifungal chemicals can also be used by humans to treat human diseases or to relieve symptoms.

Plant Disease

For the Edexcel specification, the only plant disease that we need to know about is Chalara which is commonly known as Ash die back. Let's look at this awful disease.

Disease: Chalara – Ash die back.

Details: Is caused by a fungus which infects ash trees. Infected trees suffer from leaf loss, die back of new shoots and bark lesions. The figure show some healthy Ash leaves and leaves that have been devastated by Chalara.

Spread by: as spores in the wind.

Treated by: remove and burn the infected trees.



How are plant diseases detected?

Plants can have their disease identified by:

- **Observation and manuals:** farmers and scientists can look for visible symptoms on the plant such as lesions on the bark, or dying leaves. They can compare these to gardening manuals or online disease databases.
- **Distribution analysis:** scientists can map out the pattern of where the diseased plants are located. If it is spreading in a circular patch, it might be a pathogen in the soil.
- **Eliminating environmental causes:** before farmers can assume a pathogen is to blame for the disease, they need to check the environment. They should check the soil to see if the plant isn't suffering from a lack of nutrients like magnesium or nitrates or poor conditions like flooding or incorrect pH.
- **Laboratory testing:** scientists can view the cells under a microscope, or use test kits that contain monoclonal antibodies to detect the antigens of the pathogen.

Plant Ion Deficiencies

If a plant is looking a bit sad and unhealthy, a pathogen isn't always to blame! Sometimes, the plant is simply suffering from a lack of essential mineral ions in the soil.

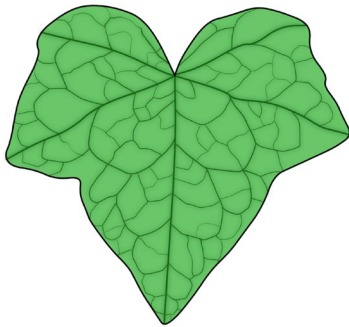
Exam note: we don't actually need to memorise these plant deficiencies for the Edexcel specification!

However, knowing what magnesium and nitrates do is very useful background knowledge that will help us answer application questions about photosynthesis and plant growth.

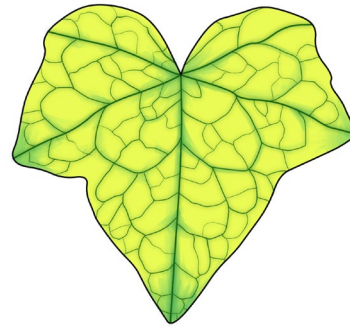
Ion: Magnesium.

Used to: make chlorophyll which absorbs light in photosynthesis.

Deficiency effect: it causes the leaves to look yellow. This reduces the plant's ability to photosynthesise. This can reduce overall growth and yield of the plant.



Normal healthy leaf



Leaf showing a magnesium deficiency

Why do the leaf veins still look green when the plant has a magnesium deficiency?

The veins often have better access to the limited magnesium still available, since they're closer to transport tissues (like xylem and phloem). That means that chlorophyll lasts longer near the veins so they stay green while the rest of the leaf tissue goes yellow.

Ion: Nitrate.

Used to: make amino acids which are used to make proteins.

Deficiency effect: the plant can appear stunted/ smaller as the plant needs proteins for growth and repair.



Healthy plant with plenty nitrate ions



Plant showing a nitrate deficiency

Colour note: we notice here that the plant with a shortage of nitrate ions is smaller than the healthy plant. We also notice that it is a little yellow in colour. Plants with a nitrate deficiency can look a bit yellow as without enough nitrate ions plants can't produce chlorophyll fast enough. They can still make it of course but the rate at which they can make chlorophyll slows down.