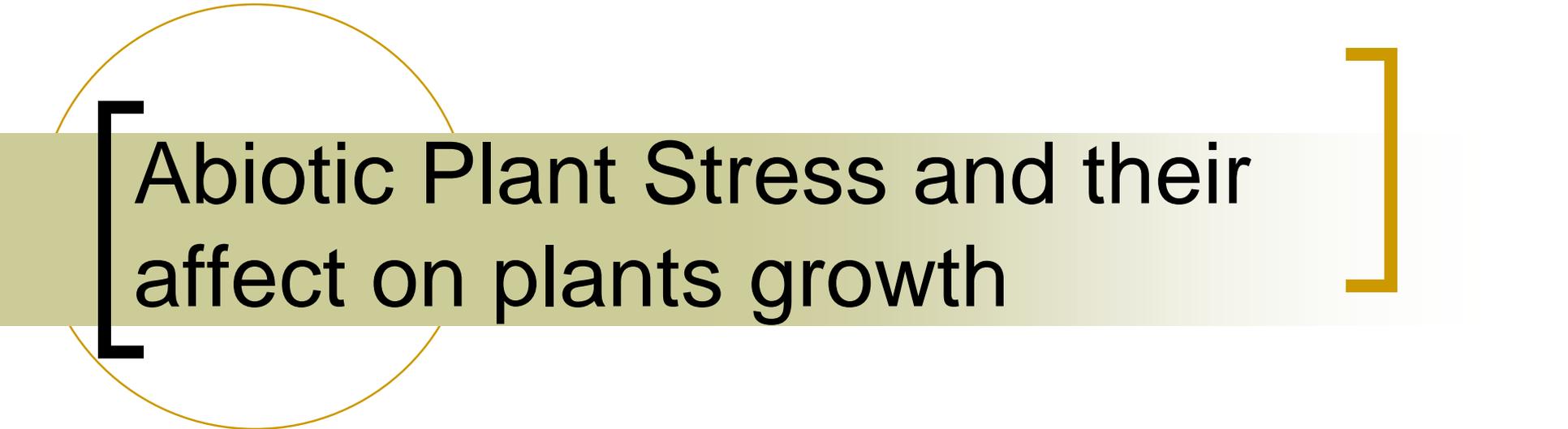


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Abiotic Plant Stress and their affect on plants growth

[Plant Stress]

- **Plant stress is defined as any change in environmental conditions that produce a less than ideal plant response.**
 - Biotic
 - Abiotic

[Biotic Factors]

- microorganisms (bacteria and fungal)
- virus
- parasitic plants
- insects

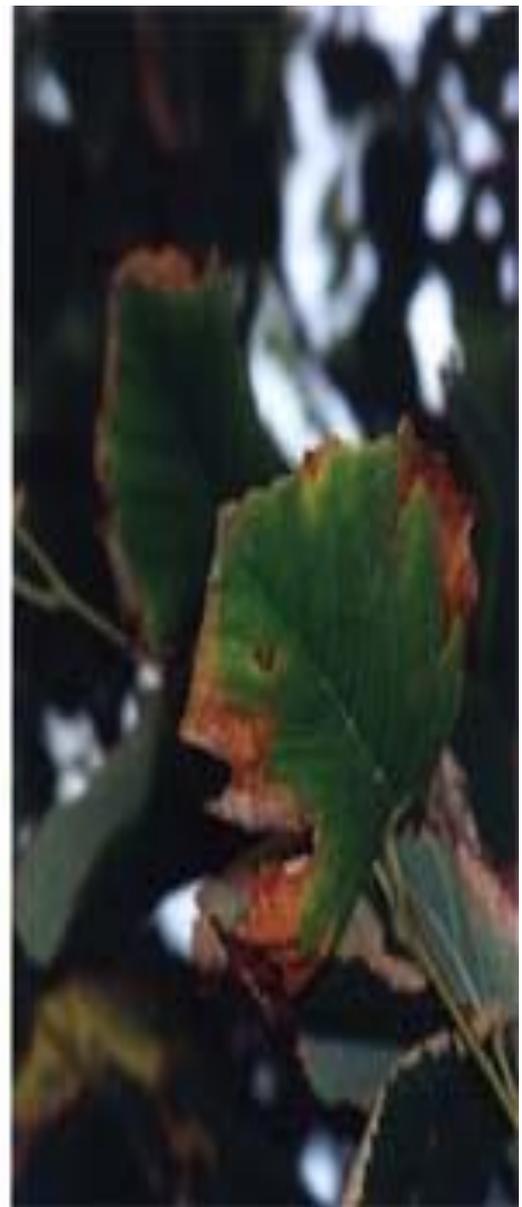
[Abiotic Factors]

- Water
- Temperature
- Light
- Soil
- Nutrients

[Water Stress]

- Drought(Deficit of water).
- Flooding(Excess of water)

Water Stress [8]



Drought

- Photosynthesis is particularly sensitive to the effects of water deficiency.
- Water deficiency yields metabolic changes along with functional and structural rearrangements of photosynthesizing apparatus.
- Photosynthesis of higher plants decreases with the reduction in the relative water content (RWC) and leaf water potential.

[Drought]

- Drought conditions bring about quantitative and qualitative changes in plant proteins. In general, proteins in the plant leave decrease during water deficiency due to the suppressed synthesis.

[Drought]

- Water stress can lead to a disturbance of the association between membrane lipids and proteins as well as enzymes activity and transport capacity of membranes.

[Drought]

- In the majority of the plant species, water stress is linked to changes in leaf anatomy and ultrastructure.
- Shrinkage in the size of leaves.
- Decrease in the number of stomata.
- Thickening of leaf cell walls.
- Cutinization of leaf surface.
- Increase in the number of large vessels.
- Submersion of stomata in succulent plants.
- In xerophytes, formation of tube leaves.
- In cereals and induction of early senescence.

[Flooding]

- Diffusion of gases through soil pores is so strongly inhibited by their water content that it fails to match the needs of growing roots.
- High carbon dioxide concentration in the soil can severely damage roots of certain species.

[Flooding]

- Flooding may also increase the incidence of soil-borne fungal diseases.
- Germinating seeds are particularly vulnerable to fungal colonization (e.g., *Gliocladium roseum*).
- An absence of oxygen is usually fatal to growing root tips.

[Temperature.]

- Heat Stress(High Temperature).
- Cold Stress(Low Temperature).

High temperature Stress



Heat Stress

- High temperatures can increase the rate of reproductive development, which shortens the time for photosynthesis to contribute to fruit or seed production.
- High temperature increase evapotranspiration and cause plant-water-deficits, leads to drought..

[Heat Stress]

- High soil temperatures can reduce plant emergence.

[Heat Stress]

- Extreme temperatures can cause premature death of plants.
- Reproductive development of many crop species is damaged by heat such that they produce no flowers or if they produce flowers they may set no fruit or seeds.

[Cold Stress]

- Under cold stress conditions, starch is converted to sugar Crop quality is reduced due to low shelf life of the produce.
- Due to extreme low temperatures seed germination is affected.
- Cold soil may slow germination and encourage rotting; called pre or post-emergence damping off

Cold Stress

- Roots resist water uptake in low soil temperatures; plants in cold soils may wilt because not getting enough water
- **Chilling injury:** plants damaged by low temperature but ice crystals did not form
 - Symptoms include: lesions, discoloration, defoliation, wilting, poor keeping quality (in fruit like bananas)
 - Chilling severely hampers the reproductive development of plants for example exposure of rice plants to chilling temperature at the time of anthesis (floral opening) leads to sterility in flowers.

[Cold Stress]

- **Freezing injury:** damage caused by freezing of water inside plant's cell, ice crystals are formed that rupture the cell membrane.

[Light]

- Photosynthesis is dependent on light.
- Accumulation of certain Pigments responsible for preventing photo-oxidation from UV light.

[Soil]

- Salt Stress
 - For most plants, the presence of high salt concentrations in the soil is an important stress factor.
- Nutrient Deficiency
 - A lack of one or more essential elements needed by plants for optimum growth lead to plant stress.

Salt Stress

- High salt concentration cause ion toxicity which results in disruption of enzyme activity.
- □ Ion imbalance e.g. High Cl concentrations inhibit NO_3 uptake. High Na replace Ca in root cell membranes result in loss of K from roots.

Salt Stress

- Net photosynthesis and stomatal conductance are significantly affected by salt stress due to changes in chlorophyll content, damage of photosynthetic apparatus and chloroplast structure.
- Increasing soil salinity levels strongly influence the essential lipids biosynthesis.

[Salt Stress]

- Salinity stress often leads to altered membrane fluidity and changes in phospholipids have recently been recognized as important events mediating osmotic stress signals in plants

Nutrient Deficiency

- A lack of one or more essential elements needed by plants for optimum growth lead to plant stress.

Macroelements

Element	Symbol
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Nitrogen	N
Phosphorous	P
Potassium	K
Calcium	Ca
Magnesium	Mg
Sulfur	S

Microelements

Element	Symbol
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Chlorine	Cl
Iron	Fe
Boron	B
Manganese	Mn
Zinc	Zn
Copper	Cu
Molybdenum	Mb
Nickel	Ni



HEALTHY leaves shine with a rich dark green color when adequately fed



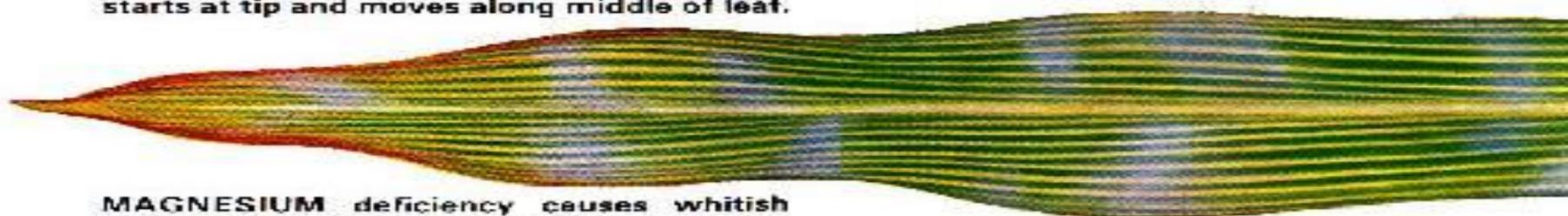
PHOSPHATE shortage marks leaves with reddish-purple, particularly on young plants.



POTASH deficiency appears as a firing or drying along the tips and edges of lowest leaves.



NITROGEN hunger sign is yellowing that starts at tip and moves along middle of leaf.



MAGNESIUM deficiency causes whitish strips along the veins and often a purplish color on the underside of the lower leaves.

