

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



# Abiotic Plant Stress and their affect on plants growth

# [ Plant Stress ]

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

# [ Biotic Factors ]

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

# [ Abiotic Factors ]

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- Water
- Temperature
- Light
- Soil
- Nutrients

# [ Water Stress ]

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- 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 ]

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- 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 ]

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- 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 ]

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- 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.]

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

## High temperature Stress



# [ Heat Stress ]

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- 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 ]

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- High soil temperatures can reduce plant emergence.

# [ Heat Stress ]

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- 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 ]

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

# [Light]

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

# [ Soil ]

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- 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  $\text{NO}_3$  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 ]

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- 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		Microelements	
Element	Symbol	Element	Symbol
Nitrogen	N	Chlorine	Cl
Phosphorous	P	Iron	Fe
Potassium	K	Boron	B
		Manganese	Mn
Calcium	Ca	Zinc	Zn
Magnesium	Mg	Copper	Cu
Sulfur	S	Molybdenum	Mb
		Nickel	Ni



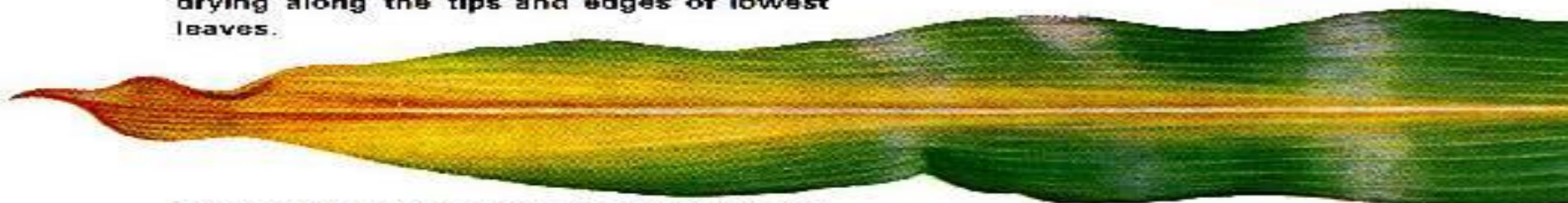
**HEALTHY** leaves shine with a rich dark green color when adequately fed



**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.

