

***Stress ,its symptoms &
approaches to reduce the stress in
crop production***



Plant stress

Contents

- Stress and its types
- Symptoms of stress
- Approaches to reduced the stress

Plant Stress

- **Stress:** Environmental damage to plants
 - ◇ Biotic stress
 - ◇ Abiotic stress
- **Resistance:** The adaptability of plants to adverse environment
 - ◇ Stress avoidance
 - ◇ Stress tolerance

Types of Stress

- Biotic stress

- ◇ pathogen stress

- Abiotic stress

- ◇ chilling stress

- ◇ freezing stress

- ◇ heat stress

- ◇ wet stress

- ◇ flood stress

- ◇ drought stress

- ◇ salt stress

} temperatures stress

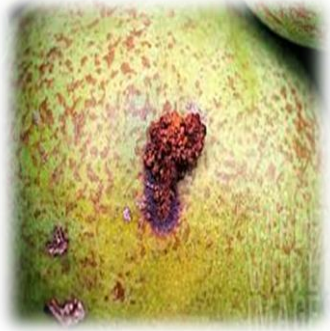
} water stress

Symptoms of stress

Biotic stress

- Pathogen stress

parasites a major cause of psychological differences among plants.



Abiotic stress

- Chilling stress

Caused by low temp. $> 0^{\circ}\text{C}$

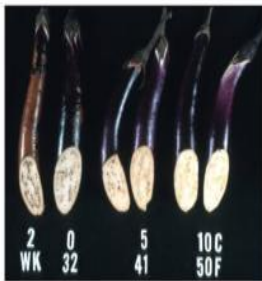
- Damage

- Membrane phase
- Root water absorption ability
- Disfunction of respiration
- Accumulation of ethanol.
- Disfunction of metabolism

Chilling stress

Eggplant Chilling Injury Symptoms

Seed Browning



*Optimal
Temperature*



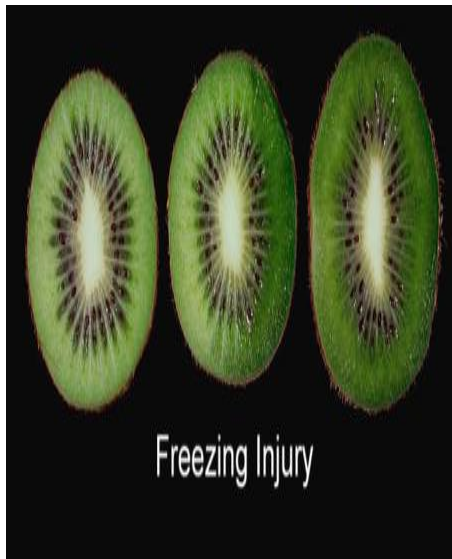
Pitting



Abiotic stress

- Freezing stress
- Freezing injury is caused by low temp. $<0^{\circ}\text{C}$
- Supercooling
- Damage caused by freezing of water inside plant's cell, ice crystals are formed that rupture the cell membrane.

Freezing stress



Abiotic stress

- Heat stress
 - Increase the rate of reproductive development.
 - High temperature increase evapotranspiration.
 -
 - Cause plant-water-deficits, leads to drought.
 - High soil temperatures can reduce plant emergence

Heat stress



Abiotic stress

- Flood stress

- 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 may also increases fungal diseases.
- An absence of oxygen is usually fatal to growing root tips

Flood stress



Abiotic stress

- Drought stress

- 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

Drought stress



Abiotic stress

Salt Stress

A small green seedling is growing in a glass flask, which is hanging from a metal stand. The seedling is green and has two leaves. The flask is partially filled with a green liquid. The background is white.

Salt stress is one of the major A-biotic stresses.

- All carbohydrates, fatty acids and protein content were adversely affected due to salinity effect.
- Salt stress induces the synthesis of abscisic acid which closes stomata when transported to guard cells, therefore, photosynthesis declines and photo inhibition and oxidative stress occurs.
- Some physiological damages also occur due to salt stress that are
 - Water deficiency
 - Ion cyto-toxicity
 - Osmotic stress
- The accumulation of Na^+ and Cl^- ions in the cells is very toxic in terms that these ions can influence the enzymatic action.

salinization of soil

- Main cation: Na^+ , Ca^{2+} , Mg^{2+} , K^+
- Main anion: Cl^- , SO_4^{2-} , HCO_3^- , CO_3^{2-} , NO_3^-
- Main salt: NaCl , Na_2SO_4 , Na_2CO_3 , NaHCO_3
- Saline soil: NaCl , Na_2SO_4 in soil
- Alkaline soil: Na_2CO_3 , NaHCO_3 in soil

Salt stress

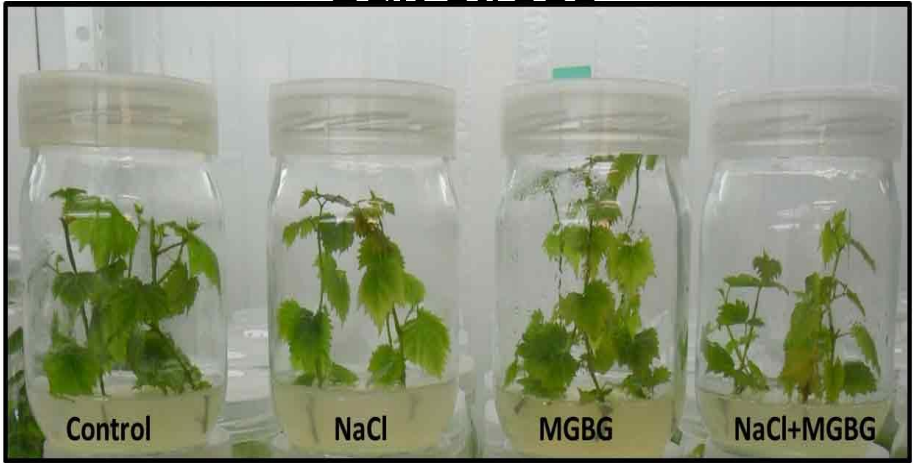
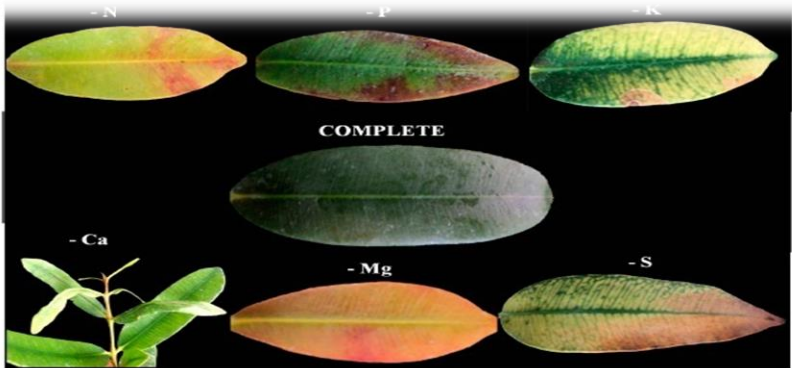



Fig. 1.- Picture showing the effect of MGBG on the growth of *in vitro* grapevine plantlets in the presence and the absence of 100 mM NaCl.

Nutrient stress

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




Nutrient stress



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



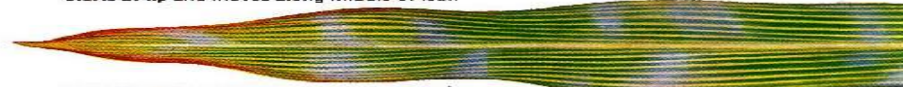
PHOSPHATE shortage marks leaves with reddish-purple, particularly on young plants.



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.

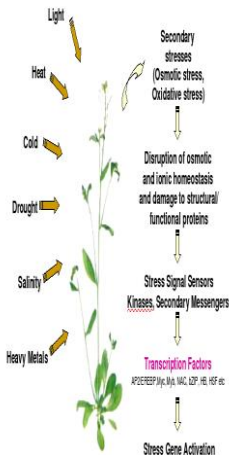
PLANT STRESS RESPONSE



Approaches to reduce Abiotic

SOME OF THE PROMINENT ABIOTIC STRESS TOLERANCE MECHANISMS

- Activation of signaling factors
- Altered gene expression
- Accumulation of compatible solutes
- Synthesis of stress proteins
- Enhanced antioxidative metabolism
- Ion homeostasis and compartmentation
- Facilitated membrane transport
- Accumulation of polyamines
- Adjustment of hormonal balance



Thank You !

