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WATER LOGGING



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As per Levitt (1980 b) flooding (i.e. water logging) is the presence of water in soil excess of field capacity.

It leads to deficiency of O₂ and build up of Co₂, Ethylene and other toxic gases and this leads to reduction in aerobic respiration.

Effects of water logging:

1. Once soil becomes water logged, air space in soil is displaced with water, the O₂ in the soil is dissolved in water. i.e. O₂ decreases; Co₂ ethylene and other toxic gases increases.
2. O₂ replacement in the soil is very inefficient. Diffusion of atmospheric O₂ into the water logged soils is very inefficient (because of the slow diffusion of atmospheric O₂ to water logged soil).



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3. Root systems are suddenly plunged into an anaerobic condition. This switching from aerobic to anaerobic respiration disrupts root metabolism.

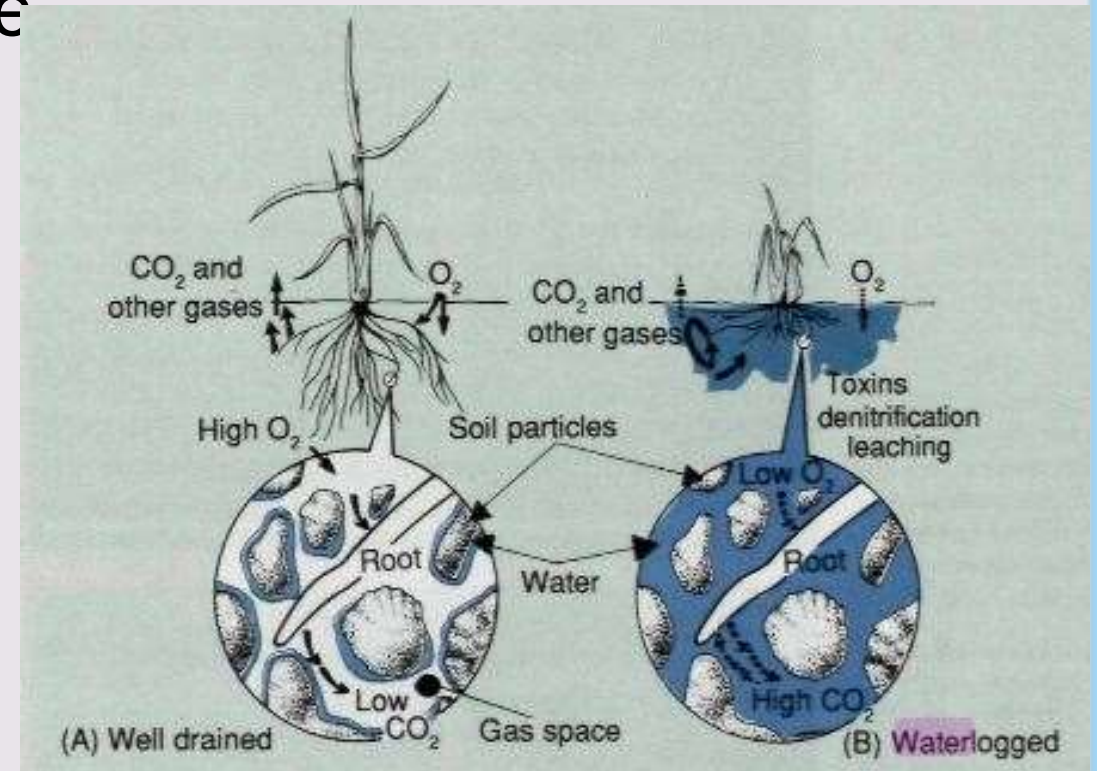
4. Carbohydrates level get depleted it is due to

a. Dissipation of metabolism

b. High water temperature

c. Low light

If air space in soil is displaced with water, the O₂ in the soil is dissolved in water. i.e. O₂ decreases





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Characteristics of plants in response to water logging stress :

1. Reduced growth / elongation.
2. Chlorosis, senescence and abscission of lower leaves
3. Wilting & leaf curling
4. Hypertrophy (increase in size of organ due to increase in cell size)
5. Epinasty (downward growth of petioles)



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Mechanisms of tolerance:

1. Adventitious root formation on lower part of stem (close to surface so that O₂ tension is quickly restored after transient water logging) eg. Tomato
2. Lenticel (i.e. raised pores in the stem of plants) formation
3. Aerenchyma formation (soft plant tissue contains air spaces found in aquatic plants) in the cortex that provide canal parallel to the axis of the root through which gases can diffuse longitudinally (eg. rice)



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4. Elongation capacity (In rice – best elongation response give 100% recovery from submergence and poorest elongation gives upto 49% recovery) Scoring for elongation can be done between booting and flowering stage after flooding the crop to varying depths.

In sugarcane, *S. spontaneum* has more tolerance to flooding. Some canes gave upto 70% of their production potential when in continuous flood for 5 months (in an east at canal point Florida, USA)



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Ideotype for flooded areas : The postulated ideotype for flooded areas should have the following characteristics.

1. Capacity to carry out functional activity at low O₂ concentration (i.e. High cytochrome activity)
2. Ability for photosynthesis under low light intensity
3. Capacity to synthesis food rapidly
4. Regeneration capacity of shoots when damaged by flood
5. Ability to withstand drought at later growth stage
6. Deep root system
7. Narrow, medium long and dark green leaves with high sugar and protein content.



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