IRRIGATION AND WATER USE: MAINTAINING HEALTHY ROOTS

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An active, deep, and extensive root system is essential for a turfgrass to exhibit maximum drought resistance and minimum water use (ET, evapotranspiration). Soil factors that directly inhibit turfgrass root development and/or viability (i.e., health) are noted in Table 1. Two major approaches to minimizing the adverse effects of these soil factors are: a) use turfgrasses with genetic tolerance to these factors and with enhanced indirect high temperature tolerance to maintain adequate net carbohydrate production in summer months, and b) use culture practices to prevent or alleviate any root limiting soil stress present on a site.

Table 1. **Primary soil factors that inhibit root growth or viability.**

Soil Physical

1. High soil strength in bulk soil or a layer, such as surface soil compaction.
2. Low soil O_2 in bulk soil or a layer.
3. High soil temperatures in conjunction with high air temperatures, especially for cool-season grasses.
4. Excessively dry soil or a soil zone.

Soil Chemical

5. Acid soil complex which includes toxicities (Al, Mn), potential deficiencies of (P, Mg, K, Ca). These soils usually also exhibit high soil strength.
6. High salinity, especially Na^+ at a level toxic to root tissues.

Soil Biological

7. Soil pathogens that infect root tissues.
8. Soil insects that damage roots.
9. Nematodes.

In addition to soil factors noted in Table 1, certain **shoot factors** also influence root development and viability. These include:

1. Adequate light for photosynthesis.

2. Adequate nutrition for optimum photosynthesis especially N, Fe, S, Mg, Mn.

3. Maintain adequate green tissue for photosynthesis – i.e., avoid excessively close mowing, scalping, wear damage, and leaf injury.

4. Maintain the ability of the plant to cool itself by transpiration through K nutrition, irrigation, syringing, air movement, and roots.

5. Select grasses with genetic tolerance to root limiting factors; indirect high temperature stress; abiotic / biotic / traffic stresses expected on the site.

Irrigation practices also determine the development of roots and their viability. Often, the influence of irrigation practices is by affecting soil physical / chemical / biotic factors (Table 1) that influence roots. Particular problems arise from:

- light, frequent irrigation in dry periods
- inadequate irrigation to maintain deep roots during drought periods
- excessive irrigation

Whenever irrigation practices alter shoot or root conditions, water use (ET) will also be affected, either in a positive or negative manner.