Relative Salinity: Comparing tolerances of turfgrass species and cultivars

Growth of development in coastal areas is pushing the development of salt-tolerant turfgrasses

Dr. Ken Marcum

The need for salt tolerant turfgrasses is ever increasing. Rapid urban population growth has put enormous pressures on freshwater supplies, prompting many state and local government restrictions on potable water use for irrigating turfgrass landscapes.

This is especially true in western states, where current water use policies require the use of saline secondary water sources (such as effluent) for irrigation of golf courses and other large turfgrass landscapes.

Also, in rapidly urbanizing coastal areas, over-pumping has resulted in salt water intrusion of wells used for irrigating turf facilities.

Tolerance defined

Substantial differences in relative salinity tolerance exist among turfgrasses. However, the "absolute" salinity tolerance of a given turfgrass cannot be specified, because environmental, soil, and plant factors interact with salinity level to influence turf salinity tolerance. For example, the salinity tolerance of Tifway bermudagrass, indicated by the salinity level causing 50% shoot dry weight reduction, was reported as 33, 27, 18.6, and 12 dS m-1 in four published studies.

Climatically, turfgrasses are more sensitive to salinity under hot, dry conditions, probably due to increased evapotranspiration, resulting in increased salt uptake. Soil factors such as water content, texture, and mineral status (particularly calcium) also have a major effect on turfgrass salinity tolerance.

Soil water content changes have a direct, immediate effect on root zone salinity, which varies with time and also with depth. Soil salinity increases greatly as the soil dries between irrigations, and also as depth increases, with salt concentrations approximately that of the irrigation water near the surface, to several times higher at the bottom of the root zone. Also, in most saline situations sodicity problems can occur, as the primary ion in most saline soils is sodium.

Salinity tolerance is not only a function of salt level, but also of total time of exposure. Turfgrass injury from salinity is cumulative.

In finer textured soils, this can result in anaerobic conditions in the root zone, which can have a more profound effect on turfgrass growth than the salinity itself.

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Relative tolerance studies

Even though the "absolute" salinity tolerance of a particular turfgrass cannot be specified, relative salinity tolerance (ex. "turfgrass A is more salt tolerant than turfgrass B") can be determined, provided that the other non-salinity growing factors listed above are held constant. To minimize the effects of variable soil and climatic conditions on plant responses to salinity, researchers have utilized solution or hydroponic culture under controlled environmental conditions (growth chambers, greenhouses) in turfgrass salt tolerance research.

In this paper, published turfgrass salt tolerance studies (approximately 80) were compared in attempt to summarize the relative salinity tolerance of turfgrass species. When cultivar comparisons within a given species have been made, I have included name(s) of salt tolerant cultivars immediately below the turfgrass species.

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Salt tolerance comparisons were made difficult, due to the different methods and growing conditions used in the studies, as well as different criteria used to measure salinity tolerance, for example: shoot growth rate reduction, root growth, shoot visual injury, plant survival, and seed germination.

However, comparisons of results between studies were possible if the studies had some turfgrass entries in common. I have summarized results in the table below. Salinity levels are only approximate, and represent the level of soil salinity that the turfgrass can tolerate and maintain reasonable quality.

Due to water restrictions, salinity is becoming a major turfgrass management issue. When saline water sources are used for turfgrass irrigation, proper irrigation and soil maintenance practices are essential (see TurfGrass Trends, September 2000, page 9). Also, choosing a salt tolerant turfgrass is equally important for long-term success.

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RELATIVE SALT TOLERANCE OF TURFGRASSES

C3 (cool season) Turfgrasses	Salinity Tolerance*	C4 (warm season) Turfgrasses
	30+ dS m-1	Saltgrass (Distichlis)
		Sporobolus virginicus
	25 dS m-1	Manilagrass
		'Diamond'
		Mascarenegrass
		Seashore paspalum
Nuttall alkaligrass	18 dS m-1	St. Augustinegrass
Weeping alkaligrass		'Seville'
'Fults'		
Lemmon alkaligrass		
	16 dS m-1	Bermudagrass
		'Tifway'
		Hybrid zoysiagrass
		'Emerald'
	14 dS m-1	Japanese lawngrass
'El Toro'		
'Crowne'		
Creeping bentgrass	9 dS m-1	
'Mariner'		
'Seaside I & II'		
'Grand Prix'		
Tall fescue	7 dS m-1	
'Alta'		
Creeping red fescue	6 dS m-1	
'Dawson'		
'Oasis' (slender c.r.p.)		
'Ruby' (strong c.r.p.)		
Perennial ryegrass	5 dS m-1	Buffalograss
'Manhattan'		Gramagrasses
Redtop		
Rough bluegrass	3 dS m-1	Centipedegrass
Kentucky bluegrass		Carpetgrass
'Nugget'		
Chewings fescue		
Hard fescue		
Sheep fescue		
Meadow fescue		
Annual ryegrass		
Annual bluegrass	2 dS m-1	Bahiagrass
Colonial bentgrass		
Velvet bentgrass		

**Salinity level of soil saturated paste extract (ECe).*