Can We Cope with Salty Water?

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IN THE PAST few years, just about every trade journal has featured articles that focus on water problems. No place is this more prevalent than in the Sunbelt areas of the U.S. Population increases have placed unforeseen pressure on natural resources, especially potable water. The Florida water management districts are focusing on water supplies, and permits for irrigation are reviewed carefully. With some 60 percent or more of the potable water for irrigating turf areas drawn from wells or lakes, the time is coming when poor quality water sources will be used for turf and landscape irrigation.

Salinity problems come primarily from two sources. Along coastal regions of the country, seawater is intruding into fresh water supplies and contaminating them by increasing the level of soluble salts. In interior regions, ancient salinity marine deposits in geological layers add soluble salts to groundwater as it passes through the layers.

Recent research has focused on identifying those turfgrass species and cultivars that are most tolerant of saline conditions. Saline water can cause salt stress and injury to plants in several ways. The primary response is a reduction in growth as a direct result of water stress. Plant nutrient deficiencies are indirectly caused by suppression of nutrient absorption. A prime example is the antagonism of sodium on the potassium uptake by the plant.

Turfgrass species have been classified according to salt tolerance based on salt levels that cause a 50 percent reduction in top or root growth. Zoysiagrass, seashore paspalumgrass, and bermudagrass have proven to be the most salt-tolerant species to grow in saline water (*Table 1*).

Among the bermudagrass varieties, there is a differential response to salinity (*Table 2*). The most salt-tolerant are Tifdwarf and Tifgreen. Surprisingly, Tifway II, which is a selection from Tifway, is not as salt-tolerant.

Most of the salinity tolerance work on turfgrass species has been conducted in solution culture experiments, which means the plants are constantly exposed to exact salinity and nutrient conditions. This would not be the case under golf course situations. Conditions would change daily, depending upon the irrigation regime, rainfall, fertilization schedules, and soil temperature.

In order to evaluate the effects of applying saline water through the irrigation system, Dr. A. E. Dudeck, of the University of Florida, has been studying salinigation for several years at a specially designed field installation. With this facility, turf plots can be irrigated with salt water of varying concentrations while maintaining the turf under field conditions.

INITIAL STUDIES have been conducted to determine the effects of using saline irrigation water to supplement natural rainfall. Turfgrass growth rates, salt buildup in the root zone, and soil fertility status were all taken into consideration. Saline irrigation was applied at twice evapotranspiration rates. No effect was seen on the growth rate or turf quality of Tifway bermudagrass at the highest salinity rate, of 3,500 ppm.

While turfgrasses can tolerate saline water for irrigation, none of them prefer it for growth. Where salinity is a problem, several measures can be taken to provide every benefit to the plant. Select the most salt-tolerant turfgrass and the best quality water available. Provide excellent drainage so that salts may be leached from the rootzone, and use excess irrigation to flush any accumulation away from the roots. Aerify, spike, and vertical mow to keep thatch to a minimum, and alleviate soil compaction so that water infiltration rates are high. Monitor soluble salts routinely in the soil and irrigation water. Research will continue to determine how saline irrigation interacts with turfgrass cultural practices, especially nutrition, and how detrimental salinity may be to immature, newly establishing turf areas.

Table 1. Salt Tolerance of Turfgrass Species

Salt Tolerance	Species	EC at 50% Yield Production*
Excellent	Zoysiagrass	37
	Bermudagrass	28
	Seashore paspalumgrass	26
	St. Augustinegrass	24
Good	Tall fescue	13
	Perennial ryegrass	12
Fair	Bahiagrass	9
	Centipedegrass	9

*Electrical conductivity necessary to effect a 50% yield reduction.

Table 2. Salt Tolerance of Bermudagrass Cultivars

Salt Tolerance	Bermudagrass
Most	Tifdwarf
▲	Tifgreen
	Tifway
	Tiflawn
	Tifway II
▼	Common
Least	Ormond

(Top) Response of turfgrasses to saline irrigation or "salinigation" are studied at a specially constructed field installation. Here the grasses are subjected to varying concentrations of saline water. Interactions between salinity, nitrogen levels, and mowing heights are studied, as well as the effects on soil conditions.

(Left) Turfgrass species and cultivars are evaluated for relative salinity tolerance under controlled conditions in the greenhouse.

(Above, center) Differential responses of cultivars to increasing salinity have been found. Tifway bermudagrass is more tolerant than Tifway II (above) as salinity levels increase. Note the reduction in topgrowth and rootgrowth under higher salinity levels for both cultivars, but more so with Tifway II.