

Contaminated Irrigation Water and Sodium Accumulation

How Evil Is It?

Good quality irrigation water is a very distinct element, conducive to growing healthy and vigorous turf. It definitely pays off to be proactive in finding the right water source, as deterioration of turf quality is a lagging indicator, the result of a fundamental problem of sodium accumulation in soil.

The detrimental impact of the 2005 drought . . . will reverberate in the coming years, unless appropriate corrective steps are taken.

Irrigation Water

A good source of irrigation water is a blessing that every golf course turf manager should cherish. Superintendents who irrigate courses with good quality water have nothing to fear. Their only apprehension, and appropriately so, should be overwatering. Not every golf course, however, has top quality water at its disposal. Thus, water quality should be a paramount concern of those superintendents who have to irrigate their courses with less than perfect water.

The scope of water contamination is apparent from water analyses performed by specialized laboratories. Several well-established parameters are measured and compared with the Minimum Water Quality Limits for turf irrigation.

Turf's worst enemy is water salinity. Sodium chloride (common salt), in particular, is harmful to plants, either directly through the leaves' follicles or, even more important, indirectly through its accumulation in soil. High salt concentrations in the soil environment create osmotic pressures that decrease the amount of water and, indirectly, nutrients for plant growth. The culprit is soluble salts that restrict uptake of essential nutrients for plant growth by occupying nutrient absorption sites on plants' roots. Turf plants growing under these conditions are susceptible to wilt and drought. Frequent light irrigation with poor quality water results in reduced rooting, impaired top growth, and poor turf density.

Water quality for turf irrigation in the U.S. has deteriorated, significantly, over the past 40 years. Many superintendents in the greater Chicagoland area, as well as elsewhere, have to deal with irrigation waters that are mediocre in quality. The harmful effect of poor quality water on the turf becomes even greater during extreme droughts, like the one we have just experienced. Furthermore, the repercussions of irrigation with the sodium-contaminated water are long-lasting and extend far beyond one season. The detrimental impact of the 2005 drought, in terms of sodium accumulation in the soil, at some of the Chicagoland golf courses, will reverberate in the coming years, unless appropriate corrective steps are taken.

Sodium Accumulation

An example of the danger of sodium accumulation, and speed at which it can accumulate in the root zone under extremely dry weather conditions, can be seen by comparing of two real-life data sets. Tables 1 and 2 below depict potassium and sodium soil contents in the root zones of sampled tees and greens. It should be noted that respective changes, showing the sharp increase of sodium in soils, have taken place over a very short period of time—less than one season. Similar levels of sodium accumulation have been detected in the

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soils of fairways, depending on water quality, the degree of water contamination, and frequency of irrigation. Although the ratios of calcium to magnesium and potassium in comparison with sodium also are important, the tables have been selected to show the more critical relationship between potassium and sodium in this context.

In general, the problem of sodium accumulation in the soil can be viewed in two different ways: on the relative, base saturation percentage, or in absolute terms (lb/acre). The soil test comparisons are presented below in both formats.

As the soil analysis results above indicate, sodium accumulation in the topsoils doubled, tripled, or even quadrupled in terms of total lb/acre soil content during last season. It is worth noting that in the case of analyzed soils of greens, sodium soil content skyrocketed in spite of superintendents' genuine effort to push potash soil contents up. In both instances, these golf courses had no other option but to irrigate with the sodium-contaminated water.

Research has shown that when sodium begins to occupy more than 3 percent of total base saturation, degradation of the soil structure

begins. Also, it should be understood that when the sodium content in the soil exceeds that of potash, the turfgrass will not respond to fertilization as expected.

Conclusion

Sodium's harmful effect on the turf quality might go undetected for some time if the soil analysis is not performed on a regular basis. The tests are especially useful after a drought like the one experienced in the Midwest in 2005. The initial stealth character of creeping sodium in the soil is rather deceiving. However, when its excessive accumulation

Table 1
TEES
Potassium and Sodium Soil Test Results Comparison
Chicagoland "ABC C.C."

TEE #	BASE SATURATION % BASIS				ABSOLUTE LB/ACRE BASIS			
	4/25/05		11/22/05		4/25/05		11/22/05	
	K POTASH	NaCl SODIUM	K POTASH	NaCl SODIUM	K POTASH	NaCl SODIUM	K POTASH	NaCl SODIUM
1	3.66	1.84	3.51	4.97	438	130	378	316
3	2.80	2.17	2.50	4.29	458	162	416	422
7	3.81	1.68	3.19	4.93	438	114	320	292
10	1.98	2.57	1.69	4.03	290	111	236	332
12	1.39	1.69	1.56	4.38	214	154	254	420
17	2.44	2.11	2.48	5.88	290	148	266	372

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Table 2


GREENS
Potassium and Sodium Soil Test Results Comparison
"Chicagoland XYZ C.C."

GREEN #	Base Saturation % Basis				Absolute Lb/Acre Basis			
	5/6/05		9/28/05		5/6/05		9/28/05	
	K POTASH	NaCl SODIUM	K POTASH	NaCl SODIUM	K POTASH	NaCl SODIUM	K POTASH	NaCl SODIUM
6	2.00	1.45	2.32	4.62	196	84	266	312
8	1.81	1.51	2.20	4.74	166	82	246	312
14	2.00	2.55	2.36	5.59	170	128	282	394
Putt.	3.67	2.04	4.02	5.74	342	112	492	414

in the rootzones reaches its critical mass, it becomes quite devastating to turfgrass. In turn, one cannot expect to change the underlying conditions overnight.

Numerous experienced and progressive superintendents manage the Chicagoland golf courses and some of them have had to deal with

the sodium-contaminated irrigation waters for years. However, not many remember a drought like the one in 2005. Those turf managers who had the water and, subsequently, soils analyzed are ahead of the curve. Knowing exactly what their specific circumstances called for, they had already made appropriate adjustments

to leach excessive sodium from the soil profiles. As a result, they can look ahead with confidence. 

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