Increased Use of Recycled Water Brings New Concerns

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The impact of high-salinity water on trees, shrubs and plants

While deicing salts used across the Midwest to clear roadways and driveways have long been an issue for adjacent turf, high-salinity irrigation water is a new culprit on the scene. As world water supplies become more scarce, conserving water takes on increased significance, and one way to conserve water is to reuse it. With the increased use of recycled water for irrigation, a new set of concerns is surfacing. Although golf course managers are familiar with the need to amend high-salinity soils, the impact of high-salinity irrigation water on trees and shrubs is a newer issue with fewer resources available.

Because recycled water use for irrigation is relatively new to the Midwest, little research exists on its impact beyond the actual turfgrass the water is irrigating. However, recycled water use for irrigation is increasing. Its impact on trees and shrubs is being felt, particularly during the first few years after planting. Identifying less sensitive varieties is taking on new importance.

State classifications vary on reused water, but in general, gray water is wastewater that does not include toilet waste or other solids. It receives only primary treatment, and in some locations may be used for nonfood crop irrigation. Effluent, or recycled, water goes through a complete water treatment process and may be used for any irrigation purpose.

Photo courtesy of the Morton Arboretum.

Jan Little of Morton Arboretum discusses salt-tolerant shrubs as she demonstrates pruning a serviceberry shrub.

Photo by Lee Riggs.

Tanna Farms Golf Course used ornamental grasses that were not damaged by recycled irrigation spray to replace some trees.

Recycled water issues

Municipal water treatment plants are often operating at, or near, capacity, which limits development. To develop new communities, developers sometimes must make major investments into existing treatment plants or develop self-sustaining communities with their own wastewater treatment plants and disposal methods.

Several golf courses in the Chicago area are using recycled water to varying degrees as an irrigation source. Located in the Chicago suburb Geneva, Mill Creek is a self-sustaining community developed with its own water supply and wastewater treatment plant. The recycled wastewater provides irrigation water for two golf courses, a city park and athletic fields.

Brett Hultquist, Tanna Farms Golf Course superintendent, said that a number of problems have occurred with trees, shrubs and bedding plants. When Tanna Farms opened as a nine-hole course in 2001, irrigation water was pumped from the wells that supply water for the development. As the residential development was completed, recycled water was used as the irrigation source, with well water supplementing the supply as needed. About five years ago, sufficient recycled water became available to provide irrigation.

“We started having problems right away,” Hultquist said. Trees, shrubs and perennial beds quickly began showing damage. “We tested our water, and our sodium was off the charts.”

Mill Creek water treatment had included sodium chloride water softening before the water was transferred to the residences. “The water softener was changed to potassium chloride, and that helped make our water more usable,” Hultquist said. “It didn’t solve the problem, but it helped.”

“We removed severely damaged trees and did not replace trees in the same spot,” Hultquist said. Lower branches were trimmed back on some damaged trees in attempts to save them. Tree placements avoided sprinkler spray, and a few sprinklers were relocated. “It was somewhat of a redesign. Some places you would love to have a tree, but you just can’t,” Hultquist said

“Most of the research we found was for the Southwest, and some of the suggested salt-tolerant varieties won’t survive here,” Hultquist said. “We worked mostly by trial and error. Horse chestnut and honey locust trees, ornamental grasses and certain perennials seemed to handle the water well.”

The trial-and-error experience helped avoid some problems as Tanna Farms opened a second nine this year. The design of the second nine avoided placements of trees and shrubs in locations where they would be hit by

irrigation sprinklers. “We used large ornamental grass beds, with perennial daylilies and some salvia varieties that had done well,” Hultquist said.

Cantigny Golf in Wheaton, Ill., opened 20 years ago at Cantigny Park, the estate of Robert McCormick, Chicago Tribune newspaper publisher. Scott Witte has been golf course superintendent at Cantigny Golf for 14 years. Witte said, “We use recycled water 100 percent and have used it continually. We get the water from the Wheaton Wastewater Treatment Plant just before it is emptied into Spring Creek. We have heavy clay soils here at Cantigny Golf, and high salinity makes our soils behave differently.” While the mature trees and shrubs present few problems, managing the soils to maintain high-quality turfgrass is a major focus.

Witte said that some trees do show damage that apparently occurred from sprinklers when the trees were young. The mature trees appear to be less sensitive to the spray, but during drought years, browning tips can be seen on some trees. Most of the trees have now grown tall enough that sprinklers hit only tree trunks rather than leaves.

Blackstone Golf Club, Marengo, Ill., opened just over two years ago. Blackstone residential development is underway, with five homes completed. Superintendent Eric Lindgren has not experienced any problems with the current well water irrigation source. The course will convert to recycled water as the residential development expands and provides sufficient wastewater.

High soil and water salinity causes injury

Dr. Robert Carrow, turfgrass professor and researcher at the University of Georgia (UGA), said, “Salinity problems haven’t traditionally been a problem in humid regions. Problems usually occur only where prolonged dry conditions exist.”

Carrow said, “Aboveground water hits the foliage, and if the tree or shrub is sensitive enough, it can be defoliated. A second type of injury occurs when salt in the soil accumulates and is taken up by trees and shrubs through their root systems. A third, less common, injury can occur to the roots if extensive salt accumulates with no drainage, and roots can actually decay. Carrow noted that rainfall in humid climates usually helps to leach out salts that accumulate in the soil.

The salinity of recycled water can vary greatly, often reaching 1,500 parts per million (PPM) or higher. Total dissolved salts may include a number of elements. Sea spray contains a much higher salt content, often around 35,000 PPM. However, shrubs and trees that naturally grow in coastal areas usually are not damaged by sea spray.

Mike Huck, an irrigation water management consultant based in Dana Point, Calif., specializes in recycled water issues. Huck noted that foliar damage, while typically higher in dry climates, could be worsened with drying winds.

Huck said, “Water and soil testing is needed to identify the type of salts

that are most prevalent. Soluble calcium can be added to the water to help alleviate the problem, but it takes time to work. Calcium sulfide works more quickly. But people need to first understand the type of salt that is creating the problem."

Huck, Carrow and Dr. Ron Duncan have co-authored "Irrigation Water Quality for Turfgrass and Landscape: Assessment and Management," scheduled for publication in December. The appendix contains a list of salt-tolerant trees and shrubs.

Photos courtesy of Mike Huck unless otherwise noted.

Trees in the foreground at a Toronto, Ont., site have been defoliated from high salinity irrigation water, while the same species in the background that are not irrigated retain their leaves.

Various pines at a California site show damage from high-salinity irrigation spray.

Identifying cold-hardy, salt-tolerant trees and shrubs

While little research exists on irrigation water salt damage to shrubs and trees in midwestern settings, a number of salt-tolerant shrub and tree lists are available. Many of the entries on the various lists are desert or coastal plants, which are not cold-hardy. Morton Arboretum in Chicago has published information to help minimize the injury to landscape plants from deicing chemicals, and has included a list of salt-tolerant trees and shrubs.

Jan Little, Morton Arboretum assistant education director, recently identified some trees and shrubs that would be expected to perform well under the high-salinity conditions found in recycled irrigation water. She recommended some specific varieties for limited maintenance and drought tolerance, as well as salt tolerance.

Suggested trees include horse chestnut, northern catalpa and honey locust. Suggested shrubs include serviceberry, Russian pea-shrub, forsythia, winterberry, shrub bush clover, bayberry and rugosa rose. The Morton Arboretum salt-tolerant list with scientific names can be accessed at www.mortonarb.org under the selection "Plant Trees."

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