Subsurface-Applied Tailored Water in Turfgrass

Lawn and turfgrass areas in the U.S. cover about 200,000 km² and may represent the single largest irrigated crop, an area three times larger than that of corn. Turfgrass areas require nitrogen (N) inputs to achieve the desired aesthetic appearance and optimal performance, and in many parts of the U.S., also supplemental irrigation. However, application of N fertilizers at rates that exceed plants requirements can result in the loss of N. Furthermore, declining water resources have forced many communities to critically evaluate how water is being used in the urban sector, particularly as a large portion is consumed for landscape irrigation, which is considered non-essential.

Therefore, developing and implementing proper fertilization and water conservation strategies for turfgrass areas has become a critical issue for both municipalities and the turfgrass industry. In the September–October issue of *Crop Science*, New Mexico State University turfgrass expert Bernd Leinauer and co-author Elena Sevostianova detail their perspective on the way forward: decentralized water treatment, drip irrigation, and fertigation.

Unlike potable water reserves, quantities of reclaimed wastewater continue to increase due to population growth, can provide a readily available source of irrigation for arid and semi-arid areas, and eliminate the need of potable water for irrigation. Adopting more effective irrigation systems can also help in reducing the amount of potable water used for turfgrass irrigation. Although sprinkler systems are the most commonly used irrigation systems for turf-dominated landscapes, they can have significant losses from runoff, wind drift, and evaporation. Subsurface irrigation systems, on the other hand, apply water directly to the root zone, thereby avoiding problems such as overspray, runoff, wind drift, and human exposure.

Fertigation involves the continuous injection of small amounts of liquid fertilizer into the irrigation stream. Studies have shown that such a method of fertilization appears to greatly reduce the risk of potential nitrate leaching. However, for fertigation to be more effective and thereby accepted, it needs to be coupled with an irrigation system that applies water uniformly, and the fertilizer injection system must be able to adjust nutrient delivery to correspond with plant requirements, thereby minimizing leaching.

Decentralized wastewater treatment technologies offer the ability to produce recycled water with varying quantities of N on relatively short notice, and using such tailored water would reduce or eliminate the need for additional mineral fertilizers if concentrations of nitrate in the water were raised during the growing season to meet the annual N requirement. However, in areas with high rainfall reaching or exceeding the overall irrigation requirement for several months of the growing season, the use of tailored water to supply N needs to be more thoroughly studied. Investigating the effects of increased N levels in irrigation water may also be important during hot summer months, when leaching fractions are typically increased to flush accumulated salts in the root zone but N requirements of the plants are low due to a slowing down in growth caused by heat stress.

Based on their model estimates and available research data, the researchers generally consider the use of tailored water as an effective and safe means to provide both irrigation and N to turfgrass areas. However, most if not all of the available data are based on studies for which irrigation water was applied to turfgrass areas from sprinkler systems. More research is needed to investigate the effects of tailored water on turfgrass quality and nitrate leaching if irrigation is applied from the subsurface. Applying the tailored effluent using subsurface drip would ensure irrigation distribution uniformity and might help allay any public fears about human contact with recycled water. Additionally, more research is needed to determine if tailored water could also be used to irrigate and fertilize native and low-maintenance grasses, as no data are available on their assimilative capacity.

The authors conclude that new existing water treatment technologies that can adjust the nutrient content in effluent water could provide the means to sustain turfgrass areas with non-potable, recycled water and reduce or even eliminate the need for mineral fertilizers.


Turfgrass test plots at New Mexico State University. Grasses irrigated with tailored water are on the right side; plots on the left side are irrigated with potable water and fertilized with calcium nitrate. Photo courtesy of Bernd Leinauer.