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Healthy Ecosystem

As urban and suburban sprawl continues, the demand for freshwater resources also increases. There is an obvious need to consider water conservation and/or the use of alternative water sources for landscape irrigation.

Demonstrating the Usefulness and Safety of Waste Water for Irrigation of Large Turfgrass Areas

The availability of fresh water for irrigation in many parts of the United States is becoming critically limited. This is especially true for irrigation of non-food and fiber production sites including parks, commercial and residential lawns, athletic fields, golf courses, cemeteries, sod farms and other landscape plantings. There is an obvious need to consider water conservation and/or the use of alternative water sources for landscape irrigation. Waste water has long been successfully used for irrigation in the Southwestern U.S. In the Northeast there has been very limited use of waste water for irrigation.

In two field studies we found in general, irrigation with simulated waste water for a three and a half month period in 2005 had little or no effect on turf quality and soil health. Applying waste water slightly increased the soil salt level (EC), with higher salt irrigation water resulting in higher soil salt level at the end of the study. All soil salt levels were, however, considered low. Kentucky bluegrass was effected more (slightly lower visual quality) by waste water irrigation than creeping bentgrass. The turfgrass grown with a normal waste water source had slightly lower visual quality in August and September than in other months. The high salt waste water irrigation caused lower visual quality from August to November than at the start of the study in July. Turfgrass quality improved from July to November when irrigated with normal irrigation water.

This initial survey of New York golf courses using or considering waste water for irrigation shows great promise. Managers found that the benefits of using the recycled waste water out weighed the costs. Especially when the waste water source was close to the golf courses, waste water offered less expensive water for irrigation. Extra management would be necessary to monitor the water and soil nutrient content through routine testing so timely adjustments could be made throughout the growing season. Managers found that having access to waste water would increase the areas irrigated and offered more play. Extra mowing and pest management may be necessary. The communities reap environmental benefits by having more water from the treatment plants diverted to golf courses where the soil would

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When considering interaction between the main factors of waste water irrigation, soil type and grass species in time (before and after irrigation), there were a few statistically significant differences observed.

serve as a bio-filter and reduce the amount of phosphorus and nitrogen reaching streams and lakes. The guidelines developed provided the necessary information on what testing should be done on waste water and how to interpret the results to use waste water safely.

Background

The availability of fresh water for irrigation in many parts of the United States is becoming critically limited. This is especially true for irrigation of non-food and fiber production sites including parks, commercial and residential lawns, athletic fields, golf courses, cemeteries, sod farms and other landscape plantings. This is true even for the Northeastern U.S. where many people perceive an abundance of fresh water. Major metropolitan water suppliers in the Northeastern U.S. are required to double the supply capacity of their systems for the three summer months that are dominated by landscape irrigation demands.

As urban and suburban sprawl continues, the demand for freshwater resources also increases. There is an obvious need to consider water conservation and/or the use of alternative water sources for landscape irrigation. Waste water has long been successfully used for irrigation in the Southwestern U.S. Waste water includes treated sewage effluent and non-human waste water, gray water. Most large-scale waste water irrigation comes from sewage treatment plant effluent.

The benefits of waste water as an irrigation source include: conservation of freshwater that would be used for irrigation, supply of small amounts of nutrients to enhance plant growth every time the site is watered, and a reduction of pollutant (phosphorus and nitrogen) discharge into surface water. The potential hazards from waste water irrigation involve salt injury to plants, long term affects on soil health (reducing in drainage and increase in runoff/erosion), other soluble compounds in the water and human pathogens in the waste water. Proper water treatment has all but eliminated the human pathogen issue. Long-term use of waste water irrigation of turfgrass sites in Arizona, a low rainfall area, has shown to increase salts levels in the soil which could harm plant growth and destroy the structure of soils.

In the Northeast there has been very limited use of waste water for irrigation. For example, in New York, there are just two golf courses of the over 850 golf courses in the state that use waste water for irrigation. One golf course (45 holes) in Lake Placid, NY gets all its irrigation water from the Village of Lake Placid. The Village of Lake Placid has reduced its phosphorus loading into Lake Champlain by 25 percent. To date, the Lake Placid golf courses, which have very sandy soil, have seen no turf damage from salt.

Study 1: Demonstrate that the waste water will not harm the turf and soil at the Newman Golf Course, City of Ithaca, NY.

The purpose of this study was to determine if watering a practice green at the Newman Golf Course with waste water similar to the one produced by the City of Ithaca Waste Water Treatment Plant would affect soil health and turfgrass quality in 2005.

Material and Methods

The practice green at the Newman Golf Course, Ithaca, NY, was used to demonstrate the safety of using waste water with the same properties generated by the Ithaca Area Waste Water Treatment Facility to irrigate the golf course. This demonstration involved comparing the waste water and the current irrigation water (Ithaca City Water). Half of the practice green received only simulated waste water supplied by a fertilizer proportioner (provided by EZ-FLO Inc., Fertigation Systems) and the other half with the current irrigation water (City of Ithaca). The irrigation started on July 20 and ended on October 31, 2005.

The simulated waste water contained the following chemical analysis:

	mg/L
Sodium (Na)	21.36
Magnesium (Mg)	15.17
Phosphorus (P)	0.32
Sulfur (S)	0.33
Potassium (K)	8.62
Calcium (Ca)	85.69
Ammonium (NH4-N)	12.07
Nitrate (NO3+NO2-N)	3.17
Chloride (Cl)	230.85 mg/kg
Electrical conductivity (EC)	0.82 dS/m

To determine the affect of waste water irrigation on the golf turf, monthly visual quality data were collected (July 18, August 15, September 20, October 18 and November 14, 2005) using a scale of 1-9, where 1 is dead turf, 6 acceptable turf and 9 ideal turf quality.

To determine the impact of waste water irrigation on soil health, soil samples at the beginning of the irrigation season (July 18, 2005) and at the end of the season (November 28, 2005), were tested for salt levels (electrical conductivity) and water infiltration rates of the soil were determined in the field.

Results and Discussion

In general, irrigation with simulated waste water for a three and a half month period had little or no effect on golf turf quality and soil health. Over time, the soil salt levels slightly increased with both sources of irrigation and both had low salt levels. Visual quality was in general good and unaffected by waste water irrigation. The water infiltrate rate was slightly lower on the half of the practice green receiving waste water irrigation but an infiltration rate of 3.5 inches per hour (8.9 cm/hr) is still considered high.

Study 2: Determine the impact of simulated waste water on turfgrass and soil health of several commonly used turfgrass species and on a wide range of soils.

The site for the second study was a rainout shelter facility at the Cornell University Turfgrass and Landscape Research Center, Ithaca, NY. The site was constructed in 1990 with three soils (sand, sandy loam and silt loam). During the irrigation season (July 20 - October 31, 2005) all rainfall was excluded from the site with a moveable greenhouse called a rainout shelter. This insured that all the water provided would be waste water, which will give the greatest chance of damage. Three types of irrigation water were used, the current irrigation water (Fall Creek), water with the same properties generated by the Ithaca Area Waste Water Treatment Facility (shown above) and water with twice as much salt and nutrients as that generated by the Ithaca Area Waste Water Treatment Facility.

Monthly visual quality data were collected on July 18, August 15, September 20, October 18 and November 14, 2005 using a scale of 1-9, where 1 is dead, 6 acceptable and 9 ideal quality. To determine the impact of waste water irrigation on soil health, soil samples at the beginning of the irrigation season (July 8, 2005) and at the end of the season (November 28, 2005) were tested for salt levels (electrical conductivity). Water infiltration rates of the soil were determined in the field on May 5, 2004 and again on February 14, 2006. Due to the extremely high infiltration rates, data for sand was not obtainable with the method we used.

Results and Discussion

In general, the use of waste water irrigation, including twice the salt level, had little or no effect on turfgrass quality and soil health as measured by soil salt level and water infiltration rate. Table 2 contains the results for each of the main three factors (irrigation source, soil texture and grass type) as well as before and after irrigation values. There were small differences observed as follows:

1. When considering only waste water irrigation, applying waste water slightly increased the soil salt level (EC), with higher salt irrigation water resulting in higher soil salt level at the end of the study. All soil salt levels were however considered low.
2. When considering only waste water irrigation, applying waste water had no effect

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The benefits of waste water as an irrigation source include: conservation of freshwater that would be used for irrigation, supply of small amounts of nutrients to enhance plant growth every time the site is watered, and a reduction of pollutant (phosphorus and nitrogen) discharge into surface water.

Clippings - Brian Eshenaur

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"Brian has provided us with a wealth of information," says Jody Mills, diagnostic horticulturist at Broccolo Tree and Lawn Care in Rochester, New York, noting that Cooperative Extension's services have been "absolutely essential" in keeping a solid IPM focus in all of Broccolo's 2,800 client properties. "I'm always amazed at the knowledge he has."

Eshenuar also started Cooperative Extension's "Great Lawns/Great Lakes" program. Highly-trained master gardeners teamed up with homeowners to apply Cornell University research information and IPM methods that keep lawns healthy and attractive while reducing the potential to pollute nearby Lake Ontario. Runoff from misapplied fertilizers and pesticides—as much as 67 million pounds of pesticides are applied to home lawns each year in the U.S.—can contribute to water pollution.

"Brian has been among our most esteemed collaborators," says Jennifer Grant, Ph.D., assistant director and community IPM coordinator for the New York State IPM Program. "We highly value his enthusiasm, innovativeness, and expertise, as well as the rich network of growers, educators, and pest management professionals he has cultivated."

Eshenaur joins the program, which also recently hired ornamentals coordinator Elizabeth Lamb, on May 16, 2006. "Our educators and the ornamental industry are excited for us to be back up to full IPM staffing," says Grant.

Integrated Pest Management promotes least-risk ways to manage pests, whether on the farm or in the community. Find out more about the New York State IPM Program at www.nysipm.cornell.edu

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on water infiltration rate or turfgrass visual quality.

3. When considering only soil type differences, the sand had the lowest soil salt levels (even though it received twice the amount of salt) and slightly lower visual quality. Both soil salt levels and visual quality values were in the acceptable range.
4. As anticipated, soil salt levels on average were higher at the end of the year than before the study, but were at a low level.
5. When only considering grass species, grass type did not influence soil salt level, water infiltration rate or visual quality.

Summary to Date

When considering interaction between the main factors of waste water irrigation, soil type and grass species in time (before and after irrigation), there were a few statistically significant differences observed as follows:

1. Independent of soil type, Kentucky bluegrass was affected more (slightly lower visual quality) by waste water irrigation than creeping bentgrass. In fact, waste water slightly improved the visual quality compared to the control water. This may be due in part to the higher salt tolerance of creeping bentgrass.
2. Independent of soil and grass type, over the course of this study, the turfgrass visual quality was influenced by the source of irrigation water. The turfgrass grown with normal waste water source (1X) had slightly lower visual quality in August and September than the other months. The high salt waste water (2X) irrigation caused lower visual quality from August to November than at the start of the study in July. In contrast, the control irrigation treatment (source was Fall Creek), resulted in slightly higher turfgrass visual quality as the study progressed.
3. Independent of grass type, there was an interaction of soil type and waste water irrigation type on turfgrass visual quality. With the normal waste water irrigation (1X), the turfgrass quality was best on the sandy loam soil, but at the higher salt irrigation or the control water treatment, the quality of turfgrass grown on the sandy loam soil had lower or similar quality to the other soils. Turfgrass grown on sand generally had the lowest visual quality for all sources of irrigation.
4. The soil salt levels (EC) were higher after the irrigation season when waste water was used. When the typical water source was used (control from Fall Creek), irrigation had no affect on soil salt level.

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