Washington State University

Quantification and Fate of Nitrogen from Amended Sand Putting Green Profiles

The Pacific Northwest has a history of constructing sand greens from pure sand, some with coarse particle sizes and without amendment in order to reduce the cost of construction. A major concern is whether nitrate nitrogen in the leachate from putting green profiles constructed of sand alone, or peat/soil amended sand, can be prevented through efficient irrigation practices, efficient nitrogen fertilizer application, reduction in total nitrogen fertilization rate, or use of deeper sand profiles. This research project will evaluate the susceptibility of these systems to nitrate nitrogen leaching and provide guidance for its correction, reduction or elimination. Lighter, more frequent applications of fertilizers from slow-release sources may be helpful. In addition, frequent, light, liquid application of ammonium sulfate, from a portion of the nitrogen supplied, may improve nitrogen uptake efficiency and improve turf quality and playability without promoting excessive thatch development.

Lysimeters were constructed during 1991 from local funds and labor. Thirty-six of the lysimeters were seeded in early October to 'Putter' creeping bentgrass (*Agrostis palustris* Huds.) and will be overseeded to local ecotypes of annual bluegrass (*Poa annua* L.) in the spring of 1992. The turf is managed as a putting green and traffic will be applied with a Brinkman traffic simulator equipped with golf cleats.

With these lysimeters, an amended sand by nitrogen rate by nitrogen application timing study was established. The field lysimeters, built similarly to USGA green specifications, are 4 ft. x 8 ft. and were constructed with a plastic reinforced liner, and each was fitted with perforated drain tube. The drain tubes are overlaid by 3 inches of pea gravel and 3 inches of coarse sand. Lysimeters are fitted with PVC suction water samplers placed at 8 to 11 inches in the profile. Irrigation timing and quantity is computer logged in each group of 12 lysimeters. The irrigation system is controlled by computer monitoring of moisture sensors located at 3 to 4 and 10 to 12 inches below the putting surface to provide optimum water management.

The growing medium consists of 12 inches of USGA specification sand, either alone or amended with ten percent sphagnum peat and two percent fine sandy loam soil. Nitrogen applications consist of three nitrogen rates (38.7, 58.1 and 77.4 g N m^{-2} annually) and two application methods (granular slow release/soluble N fertilizer in four-week applications and biweekly granular slow release N with liquid ammonium sulfate).

Leachate data collection was begun the last week of October with the beginning of fall rains on the weekend of October 20, 1991. Soil-water percolate from each lysimeter is monitored and quantified on 24-h intervals during leachate production periods. Leachate samples are analyzed by nitrate and ammonium ion sensitive electrodes and ion analyzer.

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The Effect of Salinity on Nitrate Leaching from Turfgrass

This project was initiated in March of 1991, and consists of both a field component (Las Vegas) and a greenhouse component (Reno) to examine the effects of saline irrigation water on nitrate leaching from a soil root zone and on nitrogen uptake by turfgrasses.

Las Vegas: The irrigation system and sampling hardware (lysimeters, tensiometers, neutron probe access tubes, ceramic extraction cups, associated plumbing, etc.) were installed at Horseman's Park in southeast Las Vegas during the spring and summer. Plots were then seeded with either 'NuMex Sahara' bermudagrass or 'Monarch' tall fescue at rates of 45 and 357 lbs./acre, respectively. Each turf was established under typical fairway management conditions. Bermudagrass plots were overseeded with Palmer/Prelude perennial ryegrass in October. The saline irrigation treatments will be initiated in January of 1992, after which time data collection will begin. It is anticipated that the first full season's data will be available by November 1992.

Reno: Seventy-two soil columns (6 inches diameter by 24 inches deep) were equipped with

ceramic extraction cups embedded in diatomaceous earth and backfilled with a loamy sand. Each extraction cup is connected by tubing to individual collection bottles, which are in turn connected to a common vacuum line. The 36 columns were then seeded with either 'NuMex Sahara' bermudagrass or 'Monarch' tall fescue at the rates discussed above. Establishment and growth has been rapid in the greenhouse for both species, and a dense sward has developed. Columns are fertilized once each month with ammonium nitrate (NH_4NO_3) at a rate of 45 lbs. N/acre. Supplemental iron (Fe-EDDHA) has been added regularly to correct some incipient chlorosis in the young bermudagrass. Salinity by leaching fraction treatments were started in January and samples will be collected weekly and analyzed for nitrate and ammonium.

In addition to setting up the column experiment, an experiment was conducted in nutrient solution culture to examine the effects of salinity on nitrogen uptake. Briefly, two cultivars of tall fescue were grown in solution culture for four months. 'Monarch' was chosen as a relatively salt tolerant and 'Finelawn' as a salt sensitive cultivar. Nitrogen treatments were imposed to produce N-replete turf (no N stress) and moderately N-deficient turf (daily additions of nitrate at suboptimal rates to mimic the more typical turf condition). Rootzone salinity was imposed incrementally over four weeks to final salt concentrations of 0, 20, 40, and 80 mM using a combination of NaCl and $CaCl_2$ at a molar ratio of 8:1. Nitrogen uptake was measured for either nitrate and ammonium nitrogen over a 24 hour period and these results are currently being analyzed.

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Mobility and Persistence of Turfgrass Pesticides in a USGA Green

The first-year project objectives were to construct, install, and test lysimeters for collecting percolate water in a USGA-specification green; evaluate various methodology practices for pesticide analysis; develop a quality assurance and control (QA/QC) program; and to engage in preliminary data collection. These objectives have been completed.

Stainless-steel lysimeters were installed in a USGA-specification green at the University of Florida, IFAS, Ft. Lauderdale Research and Education Center. They were fitted with stainless-steel lines for off-site collection of percolate water. Lysimeter performance was tested in three ways to determine the completeness of sample recovery and to investigate the effect of sample residency time. It was determined that recovery equaled or exceeded 97 percent. The concentration of fenamiphos remained virtually unchanged after 4 days residency in the collection reservoir, whereas after 1 and 4 days residency, diazinon was only 94 and 0 percent, respectively, of that injected.

A 19-section, 33-page quality assurance/quality control plan was developed to delineate field and laboratory protocols for such items as sampling, calibration, error determinations, chemical analyses, data reduction and validation, corrective actions, and reporting.

Methods were validated for determining certain organo-phosphate pesticides in percolate water, thatch, soil, and grass clippings.

In a preliminary field study, fenamiphos applied to bermudagrass (*Cynodon* spp.) turf was observed primarily in thatch over a 7-day period. Fenamiphos in the underlying soil generally was only 10 percent of the amount found in the thatch, and seven days after application, fenamiphos in thatch was only 10 percent of the amount observed two days after application.

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Surface Runoff of Pesticides and Nutrients Applied to Golf Turf

This year was dedicated to the establishment and characterization of the runoff plots. Plots were established with creeping bentgrass and perennial ryegrass. Shortly after germination, irrigation was used to produce steady-state runoff, and hydrographs were generated from the runoff data.