Modeling Nitrogen and Phosphorus Runoff and Leaching from Golf Courses Using PRZM3/EXAMS2

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Objectives:

1. To quantify to amounts of N and P that runoff fairways and leach from greens under various management practices with the specific intent to use the dta to calibrate predictive models.
2. To determine the amounts of N and P that runoff golf course fairways at an actual course site with the data being used to validate models calibrated in objective 1.
3. To determine amounts of N and P loss as measured in a stream and ponds within and adjacent to golf course fair ways and to determine the remediating effects of ponds on the quality of these surface waters.

Start Date: 2001
Project Duration: 2 years
Total Funding: $60,000

The project was initiated this year to determine the amounts of N and P that runoff fairways and leach from greens under various management practices with the specific intent to use the data to calibrate predictive models.

Data gathered from the first three years of support by the USGA (1998-2000) involved small plot and greenhouse data to study the potential of N and P leaching and runoff from golf greens and fairways. Results indicated that under certain management and environmental conditions, both phosphorus and nitrate-N have the potential to enter surface waters from applications of fertilizers to fairways and greens.

This project is aimed at gathering data from fairways and greens on a golf course from existing surface drains on fairways and underground drainage systems on greens. The data gathered will be used to calibrate and validate leaching and runoff models. Another aspect is to modify or design predictive models to take into account the unique properties, characteristics, and processes that occur in turfgrass as opposed to the agricultural cropping scenarios for which they are currently designed.

This year was spent getting Isco samplers installed at two greens and one fairway at the Golf Club of Georgia, which is in a suburb of Atlanta. Sampling was initiated for storm events and analyses carried out for phosphate, nitrate-nitrogen and ammonia-nitrogen. In February, 2001, an Isco sampler was installed on fairway number 8 at the Golf Club of Georgia. It samples outflow from a surface drain that has an opening near the bottom of a slope on the fairway.

Dr. Larry Shuman explains his nitrogen and phosphorous runoff research to members of USGA's Turfgrass and Research Committee during an on-site visit.

Ten storm events were sampled between February and August, 2001. For each event, up to 24 samples are taken each representing a 45 or 60-minute time period. An Isco sampler was installed to sample outflow from tile drains for each of greens 5 and 11. Eleven storm events were sampled for each green between April and August, 2001. Samples are collected after each event and analyzed for nitrate-N, ammonia-N, and phosphorus.

Phosphorus concentrations as averages of the samples taken for each of the ten runoff events sampled show that the phosphorus concentration for the event on February 22 was much higher that for the others. An ammonium phosphate fertilizer (20-4-10 plus Ronstar) at a rate to give 1 lb. N per 1000 sq. ft. was applied to the #8 fairway on February 1, 2001. Ammonia-N concentration was also very high for that event averaging over 120 mg/L ammonia-N, but the nitrate-N values for all ten events were rarely over 1.5 mg/L. The other phosphorus concentrations were also generally below 1.5 mg/L for the other nine runoff events.

There were three treatments of KNO_3 at a rate to give 0.03 lb. N/1000 sq. ft. to all the greens before the first green leachate sampling on 5/21, one treatment before sampling on 6/25 and one treatment before sampling on 7/24. Nitrate-N concentrations were among the higher values for the sampling dates immediately after the potassium nitrate was applied for #5 green. However, these concentrations are still quite low, especially compared to the 10 mg/L drinking water standard. The ammonia-N and phosphate concentrations were all at background levels for the greens.

Summary Points

- Researchers colected and analyzed runoff from a fairway and two greens at the Golf Club of Georgia.
- Phosphorus concentrations as averages of the samples taken for each of the ten runoff events sampled show that the phosphorus concentration for the event on February 22 was much higher that for the others following a complete fertlizer application.
- The nitrate-N values for all ten events were rarely over 1.5 mg/L. The other phosphorus concentrations were also generally below 1.5 mg/L for the other nine runoff events.