

Simulating Hydrology at a Long Island Turf Study Site Using the RZWQM98 Model

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Abstract

A lysimeter field study was conducted on turf at a golf course in Long Island, New York during 2006 and 2007. A bromide tracer was applied during the conduct of this study to trace water movement through the soil profile at the study site. The USDA model, Root Zone Water Quality Model (RZWQM98), was used to simulate the hydrology at this study site. Predicted hydrologic results were compared to observed results from the study for both 2006 and 2007. Additionally, turf transpiration of water at the study site was examined for the two different weather conditions experienced at the study site during 2006 and 2007.

Study Approach

- One of the objectives of the lysimeter field study was to track water movement through the soil profile into drainage water (leachate) under a supplemental irrigation regime of 150% of normal rainfall to assess pesticide leaching potential. This was accomplished by tracking the movement of an applied non-reactive bromide tracer to the lysimeters.
- The field study consisted of 4 undisturbed soil monoliths (lysimeters) treated with a potassium bromide tracer (KBr) applied at a target rate of 39.7 lb/A under typical post-emergence turf grass growing in a high-sand-content soil -considered vulnerable to leaching - at a golf course on Long Island.
- The USDA model Root Zone Water Quality Model (RZWQM98) was used to simulate the hydrology and Br movement through the soil profile at the field site using parameters selected to represent study specific weather, soil, and turf conditions.

The site: a turf-covered, fairly flat location on Long Island with relatively undisturbed soil



Lysimeter Field Study Design

- A pipe lysimeter 12 inches (30.5 cm) in diameter and 36 inches (90 cm) deep was fitted with leachate collection devices. Installation was made by pushing tubes directly into sandy soil.
- Control—one lysimeter, turf grass covering undisturbed sandy soil (sandy loam over sand)
- A treated plot of 20 x 40 ft. (for soil/turf sample):
 - turf grass covering undisturbed sandy soil
 - ½ treated 1 yr only, ½ treated 2 yrs
 - Soil samples taken 6 times a year events post treatment (0 da, 7 da, & 1, 4, 8, 12 mo) for tracking bromide tracer movement down through sandy soil
- Four treated lysimeters (for leachate samples):
 - located in "Treated Plot"
 - sampled for leachate (collected bi-weekly)



1. Preparing the pipe lysimeter plot.



2. Installing the lysimeters.



3. Withdrawing filled lysimeter to process.



4. Filled lysimeter.



5. Mesh and plate to keep sand/soil in.



6. Attaching reservoir and sampling tubes.



7. Lysimeter back into the ground.



8. Application of bromide.



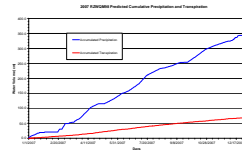
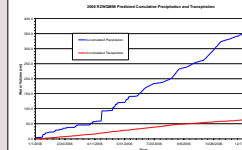
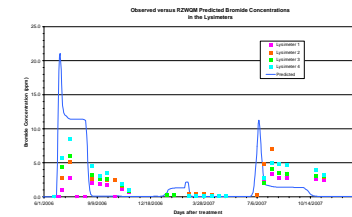
9. Sampling soil and thatch.

RZWQM98 Modeling

Input Parameter Selection

- Soil parameters based on results from site soil characterizations. Includes % Sand, % Silt, % Clay, Bulk Density, and % Organic matter.
- Daily weather data used measured values from site weather system. For missing data, values from the Islip, NY NOAA weather station (W04781).
- Field dimensions set to match those at the study site.
- The RZWQM98 built-in turf simulator, **Qckturf**, was used to simulate bermuda grass conditions. This feature allows for examination of both evaporation and turf transpiration of water.
- Br was surface broadcast applied at the observed rates of 22.41 kg/ha on June 21, 2006 and 13.45 kg/ha on June 20, 2007. Br was simulated as a non-volatile, non-degrading and non-adsorbing compound
- Neither the hydrology, soil, or Br parameters were adjusted to improve the fit between observed and RZWQM98 predictions.

Modeling Results



Conclusions from the RZWQM98 Modeling

- RZWQM98 over-predicted the 2006 peak bromide concentration by more than two times. The 2007 predicted bromide concentration was much closer to the observed with a difference of approximately 5 ppm. The 2006 differences may be due to a combination of the historically heavy rainfall that occurred at the study site shortly after the 2006 bromide application in conjunction with conservative modeling parameter selections which minimized water loss due to runoff from the field. The 2006 rainfall totals from June through December were the second wettest in the 111 year recorded NOAA history for the local Islip weather station and were in excess of the 150% water input target of the study. The 2007 rainfall totals immediately after the bromide application were in the normal range. In 2007, irrigation was necessary in to reach water input target.
- For both simulated study years, the predicted time length for the Br plume to move through the soil profile was faster than the observed bromide concentrations indicate. This is probably due to under-estimation of lateral dispersion of the water through the soil profile.
- Since both simulated study years over-estimated Br concentrations, RZWQM98 could be a useful tool for conservatively estimating the upper bound of pesticide concentrations in leachate at the study site.
- For both study years, the annual accumulated transpiration by the turf was close (64.74 cm in 2006 versus 68.51 cm in 2007). In 2006, the accumulated rainfall was 365.7 cm, thus transpiration by the turf was 17.7% of the total water input into the field. In 2007, the accumulated rainfall was 343.7 cm, thus transpiration by the turf was 19.9%. Differences are due to the differences in rainfall + irrigation, temperature, solar radiation and evaporation patterns between the two study years.



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