EFFECT OF TURF FERTILIZATION ON WATER QUALITY OF MITCHELL CREEK

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One of the areas of turf management on golf courses which is receiving significant attention from environmental groups as well as the turf industry is the impact of fertilization on surface and ground water quality. The concerns center on the potential for fertilization practices to affect: 1) leaching of nitrates into ground waters, affecting drinking water quality and 2) movement of nitrates and phosphorus into surface waters which can result in growth of weeds and algae, degrading water quality.

In the fall of 1992, a cooperative study was initiated to evaluate the impact of fertilization practices on two golf courses, grounds at a junior high school, and a softball complex on the water quality of Mitchell Creek, a small stream which flows into the east bay of Grand Traverse Bay at Traverse City in northwestern Michigan in the lower peninsula. The study was conducted throughout 1993 and 1994. Soil and water samples were collected monthly during the growing season at each course.

This monitoring was done on two golf courses, the Elmbrook Golf Course and the Mitchell Creek Golf Course. Levels of nitrate nitrogen and phosphorus were determined in soil samples collected from 3 depths on 3 putting greens (0-3, 3-6, and 6-9 inch depths) and 3 fairways (0-6, 6-12, and 12-18 inch depths) on each course. Water samples were collected from suction lysimeters installed at a 3 foot depth on 3 fairways on each course. Water in the creek was sampled monthly as well.

Nitrate nitrogen levels in the surface of greens soils (0-3 inch depth) were above the 10 ppm standard on 6 samples out of a total of 84 samples tested. At the 3-6 inch depth, 10 ppm was exceeded by 4 out of 84 samples, while there were none at the 12-18 inch depth. On fairways, the number of samples testing above 10 ppm were 6 out of 84 in the 0-6 inch depth, 8 out of 84 at the 6-12 inch depth, and 2 out of 84 at the 12-18 inch depth. Most of the fairway tests exceeding 10 ppm (12 out of 16) occurred on one fairway composed primarily of highly compacted muck. With this soil being high in organic matter and having low oxygen levels in the subsoil, it is assumed that denitrification of nitrates is significant. This should reduce the potential for leaching of nitrates.

Soil phosphorus tests in the 0-3 inch depth were determined on greens and fairways tested in the fall each of 1992, 1993, and 1994. On all 6 greens, phosphorus tests in the 0-3 inch depth were well above the level at which any phosphorus would be recommended based on soil tests. Available phosphorus in the 3-6 inch depths were lower, at levels at which modest amounts of phosphorus would be recommended for greens. In the 6-9 inch depth, phosphorus levels were lower yet. On the fairways, phosphorus tests in the 6-9 inch depth were very low, in or near the phosphorus deficiency range.

Nitrate nitrogen levels in the lysimeters were low with most samples below 0.5 ppm nitrate nitrogen. Phosphorus levels were at or below 0.3 ppm, except for one fairway where a lysimeter was broken and may have been contaminated. Three branches of the creek were sampled at the point of entry to and at the point of exit from the golf course. At no time was there an increase in the level of either nitrate nitrogen or phosphorus as the creek passed through the courses.

CONCLUSIONS

1. In over 2 years of testing, nitrate nitrogen levels in fairway and greens soils on the two golf courses were well under 10 ppm on most dates, except for one fairway. When soil nitrate levels exceeded 10 ppm this occurred in the upper soil levels except for 2 dates on that same fairway.
2. Soil phosphorus levels in greens were very high, but were reduced deeper in the soil, suggesting there was little leaching occurring. Phosphorus levels in fairways ranged from high in the surface (0-3 inches) at one course to low or very low in the surface on the other course and in the 3-6, and 6-9 inch depths at both courses. Recommendations were made for the golf courses to apply no phosphorus on turfs which had high soil phosphorus tests.
3. There was no increase in the level of either nitrate nitrogen or phosphorus as the creek passed through these courses. Water samples collected from lysimeters in fairways tested generally low in both nitrates and phosphorus.
4. The conclusion is that if golf course superintendents utilize soil testing, sound fertilization programs, and reasonable irrigation scheduling, the water quality of Mitchell Creek should not be negatively affected.
5. These results are consistent with data from other research and monitoring studies under turfgrass conditions. With good management, leaching of nitrates tends to be very low. When phosphorus is applied based on soil tests there was no significant leaching observed in these soils.