Impact of Organic and Mineral Fertilizers on Run-off from Turf

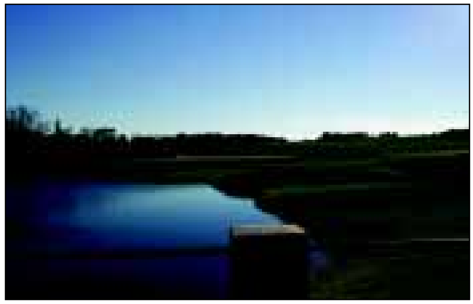
By Z.M. Easton and A.M. Petrovic

Turfgrass is an effective filter, slowing run-off and cutting sediment loss. Fertilizing it appropriately can reduce losses of nutrients in run-off.

Residential lawns comprise 82% of New York state's 3.4 million (M) acres of turfgrass, according to a recent survey. On average, homeowners spent just $31/A on fertilizers for these lawns, so it appears that rates applied fall well below rates recommended to maintain optimum quality turf.

Excesses of nutrients, particularly nitrogen (N) and phosphorus (P), can impair water quality. However, when turfgrass is fertilized with these two essential nutrients, the impact on their losses to surface water and groundwater is often unclear. Because turfgrass can reduce run-off and absorb nutrients, enhancing its growth may reduce nutrient losses, in spite of their added input.

We conducted research to compare three organic and two mineral sources of nutrients for their impact on nutrient losses in run-off. Each of the five fertilizers (see **Table 1**) provided a total of 4 lb of N/1,000 ft^2 each year. The total was split into four applications in each calendar year, starting with seeding on July 18, 2000. Applying the treatments to 3 ft. by 6 ft. plots on an Arkport sandy loam in New York, we monitored both the establishment year and the year following. We collected run-off water from 33 precipitation events. The soil



Turf that is fertilized correctly ultimately results in less water contamination.

Table 1. Fertilizers applied to turfgrass, and total clippings removed.

Fertilizer	Source	Analysis[3], %	P_2O_5 applied, lb/1,000 ft^2/yr	Clippings, % of check
Organic				
Swine compost	Bion Technologies	4.25 - 2 - 0	1.9	210
Dairy compost	Bion Technologies	0.8 - 0.3 - 0	1.5	160
Biosolid	Milorganite	6 - 2 - 0	1.4	190
Mineral				
Controlled-release[2]	SCU + Urea + MAP + MOP[1]	24 - 5 - 11	0.9	300
Soluble	Urea + MAP + MOP[1]	35 - 3 - 5	0.4	240

[1] MAP=monoammonium phosphate; MOP=muriate of potash; SCU=sulfur-coated urea
[2] Controlled-release had 45% of the N as SCU
[3] $N-P_2O_5-K_2O$

test level for P was considered adequate.

We found that fertilization increased shoot density. In our study, as shoot density doubled, water infiltration increased and reduced run-off by threefold. Thus, fertilizer treatments that promoted high shoot density tended to reduce the volume of run-off, chiefly after establishment. Fertilization also boosted the yield of clippings, and thus nutrients removed, relative to the unfertilized check (see **Table 1**).

Table 2. Losses of P and NO_3-N by run-off.

	Total losses in run-off, lb/A			
	July – December 2000 (8 run-off events)		January – November 2001 (25 run-off events)	
Fertilizer	Phosphate-P	Nitrate-N	Phosphate-P	Nitrate-N
Swine compost	0.7	7	0.9	3
Dairy compost	0.4	2	0.6	3
Biosolid	0.4	8	0.9	4
Controlled-release	0.4	7	0.5	4
Soluble	0.2	10	0.5	3
Control	0.2	5	1.2	3

At establishment, sediment clouded the run-off from all treatments. Following establishment, sediment was observed regularly in run-off only in the control treatment. Since the run-off samples were filtered through 2-micron cellulose, the P measured did not include all the particulate P that might have moved from the plots, and thus we may have underestimated total losses from the unfertilized control.

During the first 5 months after seeding, losses of P in run-off were proportional to the amount applied in fertilizer (see **Table 2**), and nitrate (NO_3^-) losses were greatest where the most soluble N source (urea) was applied.

Following the establishment period, NO_3^- losses decreased dramatically (**Table 2**). The 25 run-off events in 2001 caused less total run-off loss of NO_3^- than the eight events of 2000, and the fertilized treatments did not differ from the control. However, P losses in run-off from the control plot increased and exceeded those from all fertilized plots.

The organic fertilizer sources—particularly the swine compost and the biosolid—produced the highest losses of P. This was not surprising, since these sources supplied considerably more P than the mineral fertilizers. The low ratio of N:P thus becomes a limitation for use of organic fertilizer sources for turf, if minimizing losses of nutrients in run-off is a management goal.

Since the run-off losses we measured were immediately adjacent to small-scale plots on slopes of 7 to 9%, it should not be presumed that similar amounts would be delivered to surface waters from all turf. Landscape processes can alter nutrient losses. Slope and distance to watercourse are important factors.

Our results suggest that fertilization during establishment poses the most serious threat to water quality. During this phase it is important to apply just the right rate of nutrients needed to quickly establish the turf to enhance infiltration and reduce sediment and run-off loss.

Nutrient sources should be chosen that match the ratio of required nutrients. If P deficiency limits the speed of establishment, it may also result in increased nutrient losses in both the sediment and soluble forms. On the other hand, excessive applications could also increase losses.

Dense growth obtained by fertilizing can help reduce water contamination from N and P. The importance of accurately managing fertility for optimum environmental performance of turf is underscored. BC

Mr. Easton (e-mail: zme2@cornell.edu) is in the Plant Science Department, Cornell University, Ithaca, New York. Dr. Petrovic (e-mail: amp4@cornell.edu) is Professor, Turfgrass, at Cornell.

Reference/further information:

Easton, Z.M. and A.M. Petrovic. 2004. Fertilizer source effect on ground and surface water quality in drainage from turfgrass. Journal of Environmental Quality 33(2): 645-655.