Nutrient and Sediment Runoff Findings

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Turfgrass areas have a reputation with the unknowing public of being intensely managed with high inputs of fertilizers. Golf courses are especially visible, leading to environmental concerns about nutrient transport to surface waters. Valid or not, the facts are that over-application of nutrients can lead to nutrient runoff and eutrophication, which is often persistent with slow recovery periods. While research has been conducted in pasture situations, very little research has been conducted on the fate of fertilizer nutrients from turfgrass areas.

At the University of Georgia, L.M. Shuman (2002) found that runoff of rainfall or irrigation is directly related to application intensity and soil moisture. When the soil was relatively dry, water runoff was only 5 to 15% of that applied, whereas runoff when the soil was moist it was 50 to 80% of that added. Based on these findings, irrigation after fertilization should be minimized to reduce moisture runoff and subsequent nutrient movement from turf areas. Furthermore, fertilizer should not be applied when soil moisture is near or above field capacity or when an intense rainfall is expected.

Phosphorus concentrations in the runoff water varied directly with the amount of fertilizer applied to the site. It was also determined that a majority of the phosphorous that moved from the site as a result of runoff accompanied the initial rainfall event immediately after application, with very little being transported in subsequent events. Accordingly, from an environmental standpoint, several small applications of phosphorous throughout the year are preferable to one large application (Shuman, 2002). A note of interest, this researcher also found that the plots with no applied phosphorous still had phosphorous runoff concentrations greater than thresholds established by the U.S.

Environmental Protection (USEPA).

Nitrate N is initially low in runoff water when the ammonia form of nitrogen is applied. Nitrate amounts increase with time as the ammonia is converted to nitrate. However, the concentration of nitrate N in the runoff water for this experiment never exceeded the 10 mg L-1 drinking water standard set by the USEPA. The author recommends always applying low amounts of nitrogen, in whatever form, to prevent nitrogen from entering water bodies or streams through runoff.

Phosphorous, and to a lesser extent nitrogen, are important because they can lead to eutrophication, an over-enrichment of water bodies and streams by nutrients that can cause a subsequent proliferation of aquatic plants. The undesirable symptoms of eutrophication are algal blooms, algal mats, depletion of oxygen on lake bottoms, and a decrease in water clarity. Depletion of oxygen on lake bottoms and the subsequent release of toxins have been associated with fish kills in the past.

Besides eutrophication, environmental effects of nitrogen can include changes in productivity of natural and managed ecosystems and contamination of groundwater with nitrates. The potential adverse human health effects of nitrates in drinking water include birth defects, cancer and nervous system impairment (Taylor and Kilmer, 1980).

Meanwhile, work conducted several years ago at the University of Maryland (Krenitsky et al., 1998) looked at sediment runoff. Sediment runoff from eroding slopes is important because it can cause significant environmental problems by reducing water quality, and impacting aquatic populations. The researchers evaluated the effectiveness of natural and man-made erosion prevention materials to reduce runoff and soil erosion losses from moderately sloping hillsides.

Commonly used natural erosion materials include straw and turfgrass sod. Turfgrass sod is used extensively to re-vegetate moderately sloping hillsides, whereas straw is primarily used to facilitate seed germination and provide cover on flat to moderately sloped areas. Recently, managers have chosen to establish vegetation by broadcasting seed and covering it with a man-made material. Commercially produced man-made erosion control materials that are often used include woven or bonded mats and blankets composed of jute, straw, coconut, and wood shavings.

Use of erosion control materials are likely to reduce sediment runoff and lessen the potential for off-site movement of contaminants. Straw was found to be highly effective in reducing soil losses and delaying the time to runoff initiation when compared to bare soil. Not surprisingly, they also been found that the presence of turf reduced runoff and soil sediment losses when compared to bare soil.

The authors of this study found that on moderately sloping hillsides, natural erosion control materials, straw and sod, are equally effective or superior to man-made materials in retarding the initiation of runoff, reducing runoff rates, and reducing total soil losses. Sod offered superior performance when compared with straw in all three aforementioned categories. None of the man-made materials effectively extended the time until initiation of runoff All the erosion control materials examined by the researchers greatly reduced sediment losses when compared with bare soil and would be considered to be effective at reducing total sediment losses at construction sites (as required of DNR legislation NR-151). Of the man-made erosion control materials tested, only jute effectively reduced runoff and total sediment losses. Therefore, of the erosion control materials they tested, only sod, straw, and jute would be expected to reduce effectively both runoff and sediment losses when used at construction sites.

For more information on nutrient runoff, controlling erosion, or the ITM Program, contact Kevin at hensler@entomology.wisc.edu, or (608) 845-2545.

References

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