Preventing Nitrogen Runoff and Leaching

A variety of chemical and environmental factors influences the potential for off-site movement of nitrogen through leaching and runoff.

Nitrogen Leaching

All applied N eventually becomes the ammonium or nitrate form of N (or soluble organic N in some cases). Ammonium (NH_4) is rapidly converted in soils to nitrate (NO_3). Ammonium is also tightly held in the clay or organic profile of a soil, typically within the upper 0 to 2-inch layer. Studies typically report only trace amounts of NH_4 in leachate even under high fertilization and irrigation schedules (Bowman et al 1989b; Frank et al 2005).

Excluding the effects of runoff, nitrate (NO_3-N) presents leaching concerns for groundwater quality. Any fertilizer with solubility greater than 30 mg/L (or 30 ppm) can pose a risk for leaching and groundwater contamination. Leaching flow has been measured highest in winter and spring when plant water use is low and little N is taken up by the grass. However, “episodic” leaching events have been observed in the growing months when precipitation (or irrigation) is greater than the amount of water held in soils plus the amount used by plants.

Nitrogen Runoff

Runoff losses have been found to be five times greater on the lower slope than the upper slope in a study conducted on a 6-8% slope with sandy loam to loam soils (Easton and Petrovic 2005). The greater losses at the bottom of the slope were associated with higher clay accumulation, lower infiltration rates, wetter soils, and reduced lateral flow. The losses in the lower slopes are indirectly noted by higher saturation levels.

In general, runoff from turf during non-frozen soil conditions is due to saturation excess, not due to infiltration excess. Slope profiles in the topography of a site can lead to accumulated saturation zones that are prone to runoff. Such areas may also have shallow profiles with clay, bedrock, or other compacted soil layers (sometimes seen from construction activities) that creates or restricts lateral flow. The restrictions increase runoff losses in that area. The creation of shallow lateral flow channels tends to carry losses to other areas, including groundwater recharge.

For newly seeded sites, infiltration rates in turfgrass systems increase with age. Infiltration rates increase with increased shoot density through establishment. As infiltration rates increase, runoff decreases. Within a year after seeding, the infiltration rate can increase from 0.1 inch/hr to over 4 inches/hr. The frequency, duration, and intensity of irrigation or precipitation events can be overriding factors in ground saturation and runoff.