FERTILIZERS, PESTICIDES, LAWN CARE AND WATER QUALITY

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Some people view certain landscape management activities (particularly applications of fertilizers and pesticides) as "nonessential" and they presume these activities contribute in a significant way to the decline in water quality often associated with increased land development. Little research has been conducted on the quality of runoff emanating from suburban landscapes. Most of the information on nutrient/pesticide content of runoff is the result of research conducted on the quality of water leaving farm land. Significant amounts of nutrients and pesticides have been found in agricultural runoff, usually in the eroded sediment suspended in it. Where grass buffer strips have been used between agricultural fields and receiving waters, concentrations of nutrients and pesticides were found to decrease after the water traversed the buffer strips. Such information provides indirect evidence of the potential that turf may have to improve the quality of water associated with it. It has been documented that when land development increases, the pervious portion of the watershed decreases and is subsequently replaced by impervious surfaces such as streets, rooftops, parking lots, and others. These surfaces contribute significantly to increased quantities and decreased quality of water.

The Landscape Management Research Center, was developed at the Pennsylvania State University on a site formerly used for soil erosion research. The objective of this interdepartmental project (Agronomy, Agricultural Engineering, Entomology, Plant Pathology, and Horticulture) is to investigate the effects of turf and landscape management activities on the quality of urban runoff and leachate. Development and construction of the physical facilities involved the renovation of the soil erosion research area, fabrication of collection and subsampling equipment, instrumentation and data logger linkage with computer access, and establishement of turfed slopes on which the applications of nutrients and pesticides could be made. Slopes were established with either PA Certified Kentucky bluegrass sod or one of two seeding mixtures: A high quality mixture of perennial turfgrass species (Penn State recommendation) or a commercial "contractors' mix" containing a high percentage of annual ryegrass. By late 1985, the facility was completed and since that time much of the research has focused on the hydrological characterization of the sloped sites involved.

Preliminary Results

In 1985, the individual plot irrigation systems were equipped to deliver 3"/hour, but this intensity was not capable of producing consistent runoff from the sodded plots. Hence, the irrigation system was equipped in 1986 with heads capable of delivering 6"/hour. When interpreting runoff results it should be remembered that the 3"/hour x 1 hour storm occurs with a frequency of approximately once every 125 years, while the 6" storm is off the probability charts and appears to have a frequency of once every several hundred years. However, 6" heads were required to study the hydrological characteristics of the site. Even under these highly exaggerated storm conditions, no more than 5% of the water ever ran off of the sodded plots.

During the experimental period (August, 1986 to September, 1988), no detectable levels of runoff were documented from natural precipitation events. On several occasions, however, nondetectable flow produced amounts of runoff sufficient for quality analyses. For the individual runoff events significantly higher peak runoff flow rates and total runoff volumes were found for seeded plots.

It is likely that the presence of vegetative cover from the day of establishment prevented the degradation of surface soil aggregates that would otherwise contribute to crusting and reduced infiltration rates. In addition, the 17 to 25 mm thatch layer associated with the bluegrass sod provided an interception-like storage capacity for a nearly equivalent amount of water, as well as a tortuous flow path that significantly reduced flow velocity along the surface. The resulting increase in surface residence time allowed greater infiltration instead of overland flow. Neither of these vegetation related phenomemon were factors on the relatively thatch-free seeded plots.

Analyses of water samples for nitrogen, phosphorus, and potassium showed that average concentrations of these nutrients in runoff and leachate did not exceed 10 ppm even when sampled as early as two days after their application. Most samples contained less than 5 ppm. Overall, nutrient concentrations in samples rarely exceeded those observed in the water used for irrigation.