Nutrient pollution as a result of excessive fertilizer application is of major concern for Florida's water resources. Excess fertilizer can be lost either via surface runoff or by leaching through the soil mass eventually reaching water bodies and leading to eutrophication. The focus of this study is to analyze the effect of low rainfall intensities and overland flow from an adjacent roadway surface on the loss of nutrients from two different fertilizers. This study focuses on the fate of the nitrogen and phosphorus present in fertilizers utilized by the Florida Department of Transportation for the stabilization of highway embankments. This research was performed on a field-scale test bed and rainfall simulator located at the Stormwater Management Academy at the University of Central Florida.

The loss of nutrients was measured from two soil and sod combinations typically found in Florida and used for highway stabilization “Pensacola Bahia” on AASHTO A-2-4 soil and Argentine Bahia on AASHTO A-3 soil. Two different fertilizers were analyzed, an all-purpose, quick-release 10-10-10 fertilizer previously used by FDOT, and the new slow-release 16-0-8 fertilizer, both applied at 0.5 lb/1000 ft² consistent with FDOT's practice. Each combination was analyzed under two rainfall intensities: 0.1 in/hr and 0.25 in/hr at a slope consistent with typical highway cross-sections found in Florida. Nutrient losses were measured by collection of runoff and/or baseflow that escaped the test bed. Additionally, from the soil samples collected throughout the testing period, the mass of the nutrients was compared to the mass balances values based on literature from a previous study on fertilizers performed at the Stormwater Management Academy.

The experimental findings of this study showed that there was a reduction in total nitrogen and total phosphorus on both A-2-4 and A-3 at the 0.25 in/hr intensity as a result of switching to the slow-release 16-0-8 fertilizer. Results from the 0.1 in/hr rainfall intensity, which were available only for the A-2-4 soil, showed that at this intensity there was no apparent benefit to the switch in fertilizers. Furthermore, it was found that less total nitrogen and total phosphorus was lost from A-3 than A-2-4 at 0.25 in/hr when using 10-10-10. At 0.1 in/hr, there was no apparent difference in total nitrogen lost. However, less total phosphorus was lost at this intensity.

The results of this study showed that there is an environmental benefit to applying slow-release fertilizers. This was more significant for the 0.25 in/hr intensity than the 0.1 in/hr intensity at which no apparent benefit was found. In addition, it was found that runoff was a greater source of nutrient loss than baseflow, although baseflow losses were substantial. Furthermore, it was found that total nitrogen tends to be lost via both pathways of runoff and baseflow while phosphorus has a lower tendency to leach through the soil but readily runs off the soil surface. It was also observed that since fresh sod tends to be heavily fertilized, applications of fertilizer could be reduced or avoided entirely after sod placement and applied later, as needed.

Major: Environmental Engineering

Educational Career:
Bachelor's of Environmental Engineering, BS, 2012, University of Central Florida

Committee in Charge:
Manoj Chopra, Chair, Civil, Environmental, & Construction Engineering
Andrew A. Randall, Civil, Environmental, & Construction Engineering
Dingbao Wang, Civil, Environmental, & Construction Engineering

Approved for distribution by Manoj Chopra, Committee Chair, on May 16, 2014.

The public is welcome to attend.