Use of Turf Management Practices to Reduce Nutrient and Pesticide Loads with Runoff from Fairway Turf

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The use of fertilizers and pesticides in highly managed turf systems has raised questions concerning their off-site transport to surrounding areas. To address these questions we designed experiments to measure the quantity of fertilizers and pesticides transported with runoff from turf plots managed as a golf course fairway (creeping bentgrass, 1.25 cm height of cut). Three cultural practices: 1) hollow tine aerification, 2) solid tine aerification and 3) hollow tine aerification with vertical slicing were evaluated during two field seasons to determine their capacity to reduce surface runoff and chemical transport with runoff. Fertilizer (18-3-18 [N, P2O5, K2O]) and a commonly utilized herbicide (2,4-D), insecticide (chlorpyrifos) and fungicide (flutolanil) were applied to all plots 12-36 hours prior to the intiation of the simulated precipitation. Preliminary results show selected management practices can reduce runoff volumes and the off-site transport of nutrients and pesticides with runoff.

Hollow tine aerification reduced runoff volume and chemical transport relative to solid tine aerification.

During the initial field season, half of the plots were aerated with solid tines while the remaining plots were aerated using hollow tines. Cores removed with the hollow tines were allowed to dry, broken into smaller pieces, and worked back into the turf. A back-pack blower and leaf rake removed the turf and thatch from the plot surface. Forty-eight hours prior to chemical application each plot was pre-wet to saturation to ensure uniform water distribution. Simulated rainfall was applied to the plots 12-36 hours following fertilizer and pesticide application. Fertilizer and pesticides were applied at two different time points allowing rainfall simulations and collection of resulting runoff to be completed 2 days and 63 days following aerification (2d, 63d).

Runoff volumes were reduced in fairway turf plots managed with hollow tines relative to solid tines. When plots were aerated 2 days prior to initiation of the rainfall simulations the plots receiving hollow tine aerification demonstrated a 25% reduction in total runoff volume. Similar trends were observed when plots were aerated 63 days prior to simulated rainfall and runoff; however, the reduction in runoff volume with hollow tine aerification was reduced to 10%. Measured quantities of nutrients in runoff revealed reduced phosphorus (soluble-P) and ammonium nitrogen (NH4-N) losses with runoff from turf plots managed with hollow tine aerification. The 25% reduction in runoff volume from turf plots aerated with the hollow tines 2 days prior to fertilizer application resulted in a 49% and 60% reduction in soluble-P and NH4-N, respectively. Reduced nutrient losses with runoff from the hollow tine plots remained above 30% even when time between aerification and runoff increased to 63 days. Similar trends were observed for the pesticides. Runoff collected from turf plots managed with hollow tine aerification contained 14 to 36% and 5 to 26% fewer pesticides than runoff collected from turf plots managed with solid tine aerification at 2 and 63 days following the management practice.

Solid tine aerification

Hollow tine aerification

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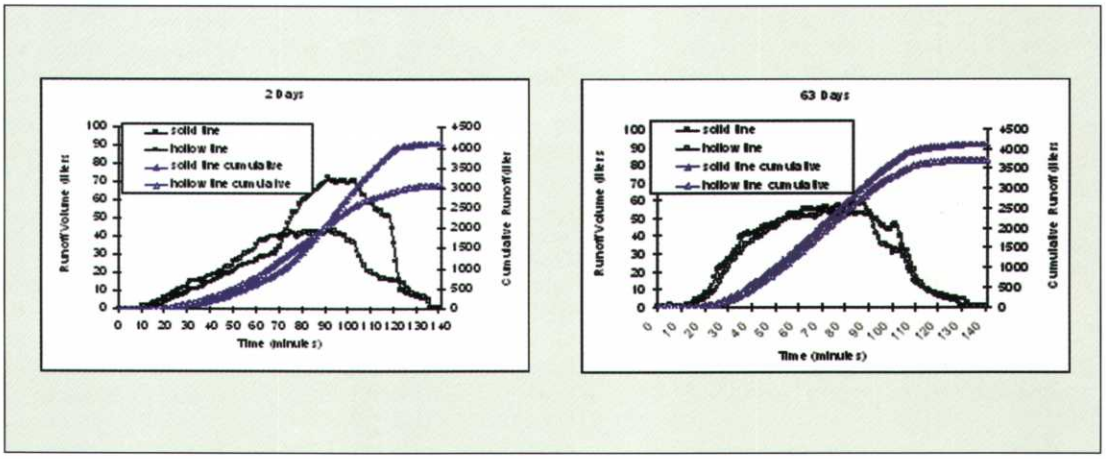

Runoff hydrograph and cumulative runoff from fairway turf plots aerated with solid tines or hollow tines two days and 63 days prior to simulated rainfall runoff.

Turf Management Practices-

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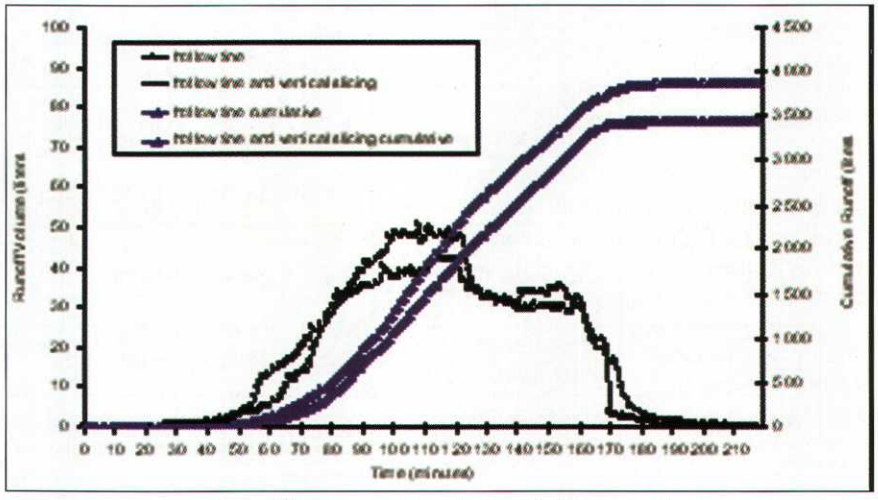
Addition of vertical slicing reduced runoff volume and chemical transport from plots managed with hollow tine aerification.

An additional cultural practice, vertical slicing, was evaluated during the 2006 season. Prior to the first rainfall simulation and collection of runoff, all plots were treated identically with weekly sand top dressing and aerated with hollow tines eleven days before to the chemical application. Cores removed with the hollow tines were allowed to dry, broken into smaller pieces, and worked back into the turf. Volumes of runoff collected from the plots were similar (3,586 ± 901 liters, former hollow tine plots; 3,447 ± 1,040 liters, former solid tine plots). Five weeks following the first rainfall simulation, all plots were aerated a second time. Seven days later half of the plots received vertical slicing to increase water infiltration and further manage the thatch. The fertilizer and pesticides were applied 8 days following the vertical slicing and within 24 hours of the second rainfall simulation.

Vertical slicing to manage turf thatch

Infiltration measurements, quantification of runoff volumes and examination of hydrographs revealed the addition of vertical slicing to hollow tine aerification increased water infiltration and further reduced (11%) quantities of water leaving the turf plots as runoff. Chemical analysis of the runoff water revealed a 14 to 40% reduction in nutrient loss and a 10 to 38% reduction in pesticide loss.

Understanding pesticide and fertilizer transport with runoff and identifying strategies that reduce off-site transport of applied chemicals will increase their effectiveness at intended sites of application and will minimize potential undesirable impacts to surrounding surface water resources.



Runoff hydrograph and cumulative runoff

Tuesday, December 4, 2007

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