

Reducing Pesticide and Nutrient Loads from Fairway Runoff Utilizing Management Practices

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Objectives:

1. To quantify pesticide transport with rainfall runoff and evaluate the ability of management practices to mitigate pesticide and nutrient loss with runoff.
2. To evaluate the mobility of snow mold fungicides and late-fall fertilizer with rainfall and snow-melt runoff.
3. To determine the impact of location of chemical application to their transport with surface runoff.

Start Date: 2005

Project Duration: three years

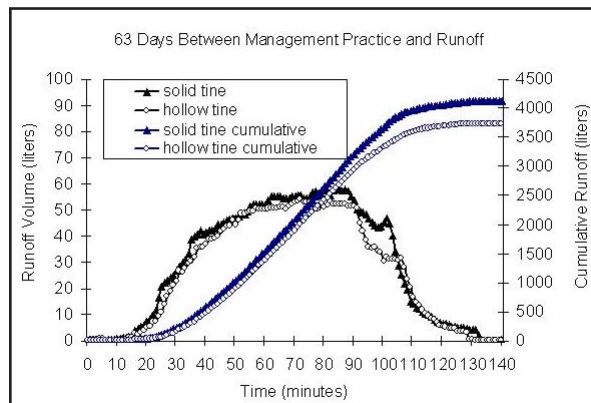
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We designed experiments to measure the quantity of fertilizers and pesticides transported with runoff from golf course fairway turf, and to evaluate the ability of management practices to reduce the transport of applied chemicals with runoff. During the 2005 season, half of the plots were aerified with solid tines, while the remaining plots were aerified using hollow tines. Cores removed with the hollow tines were allowed to dry, broken into smaller pieces, and worked back into the turf.

Fertilizer (18-3-18;N, P₂O₅, K₂O), a conservative tracer (potassium bromide), and a commonly utilized herbicide (2,4-D), insecticide (chlorpyrifos), and fungicide (flutolanil) were applied to all plots 12-36 hours prior to the initiation of the simulated precipitation. Rainfall simulations and collection of resulting runoff were completed 2 days and 63 days following aeration (2d, 63d).

Runoff volume was reduced in fairway turf plots aerated with hollow tines relative to solid tines. When plots were aerated 2 days prior to initiation of the rainfall simulations, the plots aerated with hollow tines demonstrated a 25% reduction in total runoff volume compared to plots aerated with solid tines. Similar trends were observed when plots were aerated 63 days prior to simulated rainfall and runoff. However, the difference in measured runoff volume was reduced.

Chemical analysis of the runoff water revealed smaller quantities of phosphorus (soluble-P) and ammonium nitrogen (NH₄-N) measured in the runoff from turf plots managed with hollow tines. Reduced nutrient losses with runoff from the hollow-tine plots remained above 30%



Preliminary results of fertilizer transport show reduced runoff volume (above), nitrogen loss, and phosphorus loss with hollow-tine aeration compared to solid-tine aeration.

even when time between aeration and runoff increased to 63 d. Loads of nitrate nitrogen (NO₃-N) displaced from the turf plots with runoff were similar for both management practices for each time duration between aeration and simulated rainfall. Initial results of the pesticide analysis show an 8 to 55% reduction in quantity of pesticides measured in runoff from plots aerated with hollow tines compared to solid tines.

An additional management practice, vertical mowing, was evaluated during the 2006 season. Prior to the first rainfall simulation and collection of runoff, all plots were treated identically with weekly sand topdressing and aerified with hollow tines 11 days before 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.

Five weeks following the first rainfall simulation, all plots were aerified a second time. Seven days later, half of the plots received vertical mowing to increase water infiltration and further manage the thatch. The fertilizer, pesticides, and conservative tracer were applied 8 days following the vertical mowing and within 24

hours of the second rainfall simulation. Chemical application, rainfall simulation, and sample collected followed the protocol initiated in 2005.

Infiltration measurements, quantification of runoff volumes, and examination of hydrographs revealed the addition of vertical mowing increased water infiltration and further reduced quantities of water leaving the turf plots as runoff. Measured nutrient

and pesticide loads transported with the runoff showed the addition of vertical mowing reduced soluble-P and ammonium nitrogen (NH₄-N) losses by more than 30% and fungicide (flutolanil) and insecticide (chlorpyrifos) losses by 13 to 33%.

This year, 2007, additional cultural practices were implemented followed by chemical application, rainfall simulation, and sample collection. Results of this research will provide information that will allow for informed decisions on best management practices that are both environmentally responsible and provide quality turf.

Summary Points

- Aeration of fairway turf with hollow tines reduced runoff volumes, nutrient loss with runoff, and pesticide loss with runoff compared to management with solid tine aeration.
- Addition of vertical mowing to hollow tine aeration increased water infiltration and further reduced quantities of water leaving the turf plots as runoff.
- Addition of vertical mowing to hollow tine aeration reduced the off-site transport of nutrients (soluble-P, NH₄-N) and pesticides (flutolanil, chlorpyrifos) with runoff.