

Course Care: Reducing Pesticide And Nutrient Runoff

Scientists at the University of Minnesota investigate how superintendents play a key role

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Research at the University of Minnesota determined that solid-time coring was less effective than hollow-time coring in reducing runoff losses from fairway turf. (USGA Green Section)

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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, PzOs' KzO), 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 two 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 two days prior to initiation of the rainfall simulations, the plots aerated with hollow tines demonstrated a 55 percent 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 to 10 percent.

Chemical analysis of the runoff water revealed a greater than 30 percent reduction in quantities of phosphorus (soluble-P), ammonium nitrogen (NH₄ - N), and nitrate nitrogen (NO₃ - N) measured in the runoff from turf plots aerated with hollow tines two days prior to initiation of the rainfall simulations compared to plots aerated with solid tines. A 5 to 27 percent reduction in nutrient loss with runoff from the hollow-tine plots remained even when the time between aeration and runoff increased to 63 days. Results of the pesticide analysis show a 15% to

56% 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 thatch. The fertilizer, pesticides, and conservative tracer were applied eight days following the vertical mowing and within 24 hours of the second rainfall simulation. Chemical application, rainfall simulation, and sample collection followed the protocol initiated in 2005.

Infiltration measurements, quantification of runoff volumes, and examination of hydro graphs 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 nitrate nitrogen (NO₃-N) losses by 27 % and 39% and fungicide (flutolanil) and insecticide (chlorpyrifos) losses by 11% to 29%.

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 offsite transport of nutrients (soluble-P, NO₃-N) and pesticides (flutolanil, chlorpyrifos) with runoff

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