Evaluation of Best Management Practices to Protect Surface Water Quality from Pesticides and Fertilizer Applied to Bermudagrass Fairways

Dr. James H. Baird

Oklahoma State University

Goals:

- *Develop effective and practical management practices that protect surface water from runoff of pesticides and fertilizer applied to golf course fairways and other turf areas*

Cooperators:

James Cole
Dr. Raymond Huhnke
Dr. Nicholas Basta
Dr. Gordon Johnson
Dr. Daniel Storm
Dr. Mark Payton
Dr. Michael Smolen
Dr. Dennis Martin

A portable rainfall simulator is being used to simulate heavy precipitation events that may occur shortly after the application of pesticides and fertilizer, thus increasing the likelihood of water contamination from surface runoff. The simulator is capable of applying rainfall intensities of up to 5 inches per hour onto four plots, each measuring 6 ft by 32 ft. In 1995, a preliminary study was conducted to evaluate the effectiveness of various combinations of buffer-strip: 1) length (0 vs. 8 ft. vs. 16 ft); 2) mowing height (0.5 inches vs. 1.5 inches); and 3) aerification (solid-tine aerification vs. no aerification) in reducing pesticide and nutrient runoff.

In July, an experiment was conducted at a location in Stillwater, OK consisting of common bermudagrass maintained under golf course fairway conditions. Within 24 hours prior to a simulated rainfall event, 2,4-D, mecoprop, and dicamba (formulated as Trimec™ Classic), chlorpyrifos (0.5G), nitrogen (urea) and phosphorus (triple superphosphate) were applied at normal rates recommended for fairway turf to designated areas on plots containing the buffer treatments. One of the treatments, containing no buffer-strip, was left untreated to determine the amount, if any, of pesticides and nutrients already present in the turf environment.

The experimental design was an unbalanced, randomized incomplete block with eight treatments and four replications. The design insured that important treatment

comparisons showed up in the same simulator set-up (block) at least twice.

The experiment was repeated in August, whereupon the untreated control was substituted with a treatment consisting of no buffer-strip and application of identical rates of the 50WP formulation of chlorpyrifos and the sulfur-coated-urea form of nitrogen fertilizer, in addition to identical rates and formulations of the herbicides and phosphorus.

Soil moisture conditions prior to the July and August simulated rainfall events were significantly different and affected the volume of runoff from plots and the total amount of pesticides and nutrients recovered. In the July run, no natural precipitation was detected within 12 days of simulated rainfall; by contrast, 6.5 inches of natural precipitation fell on the runoff site within 6 days of the simulated rainfall in August.

In July, percent recovery of pesticides and nutrients was less than 3% and 2%, respectively, based upon the total amount applied. The highest levels of nutrients and pesticides were recovered from the treatment containing no buffer-strip. In August, percent recovery of pesticides and nutrients was as great as 15% and 11%, respectively.

Results from the July run indicated that buffer-strips were very effective in reducing pesticide and nutrient runoff. Although few treatment comparisons were statistically significant, numerical trends from the July data showed reduced pesticide and nutrient runoff from the 16-ft buffer length compared to the 8-ft buffer length, the 1.5in mowing height compared to the 0.5-in mowing height, and solid-tine aerification compared to no aerification at the 0.5-in mowing height. At the 1.5-in mowing height, aerification resulted in greater pesticide and nutrient runoff. It is possible that the aerification process created channels in the higher-cut turf canopy, thus expediting movement of the chemicals in surface runoff.

In August, several of the trends observed in July were reversed, possibly indicating that the effectiveness of the buffer-strip treatments was overcome by the increased volume of surface runoff. Reduced pesticide and nutrient runoff occurred from the wettable powder formulation of chlorpyrifos compared to the granular formulation, and from the sulfur-coated urea form of nitrogen compared to urea. The correlation between the physical and chemical properties of pesticides and nutrients and their relative runoff potential was substantiated by this investigation.

Based upon the 1995 preliminary study, the following management practices are recommended to reduce pesticide and nutrient runoff. 1) incorporate a buffer-strip between surface water features and treated areas; 2) avoid application of pesticides and fertilizer when high soil moisture conditions exist; and 3) develop pest and nutrient management programs that utilize pesticide and fertilizer formulations with low runoff potential.