cur naturally in the field, and the results will give a clear picture of the leaching potential of the soil (Owosso sandy loam) used in this study.

The project consists of three separate areas. First, the amount of nitrate leaching from late-fall versus early spring applications of ^{15}N labeled urea is being investigated. This study also will examine the fate of nitrogen over a three year period and will focus on the cycling and forms of nitrogen in the soil. Second, five fungicides, two herbicides, and one insecticide will be applied to the lysimeters and leachate will be tested for the presence of these pesticides over the next three years.

The last objective of the study is to examine the mobility of phosphorus in putting green soil mixes. Phosphorus has little mobility in soils with appreciable clay content; however, movement can occur in soils that are mostly sand. This study involves collecting samples from recently constructed greens throughout the United States, and will test these mixes for phosphorus adsorption capacity. Also, phosphorus mobility on pure sand greens will be examined at the Hancock Turfgrass Research Center.

University of California, Riverside

The Fate of Pesticides and Fertilizers in a Turfgrass Environment - Dr. Marylynn V. Yates

The purpose of this project is to study the fate of pesticides and fertilizers applied to turfgrass in an environment which closely resembles golf course conditions in southern California. The goal is to obtain information on management practices that will result in healthy, high quality turfgrass while minimizing the potential for detrimental environmental impacts.

The specific objectives of the project are to: 1) compare the leaching characteristics of pesticides and fertilizers applied to creeping bentgrass greens and bermudagrass fairways; 2) study the effects of soil type and irrigation regime on the leaching of pesticides, nitrates and phosphorus; 3) compare the leaching and volatilization characteristics of nitrates from different fertilizers; 4) measure the volatilization rate of pesticides from turfgrasses into the atmosphere as a function of time after application; and 5) monitor the effects of different irrigation regimes, fertilizers, and soil types on turfgrass quality.

The research site consists of 36 plots, each measuring 3.7 m x 3.7 m (12 ft. x 12 ft.). The fairway area consists of 24 plots, 12 each of two different soil types that have been located randomly in the fairway area. The soil mixture used in the putting green area is a Caltega IV green sand containing 10 percent sphagnum peat. Two different soils are being used in the fairway area to represent the ends of the spectrum in terms of leaching potential, while still being representative of actual golf course soils. One of these is a fine sandy loam, the native soil at the site. The other soil is a fine sand that has been brought to the site.

Irrigation is controlled electronically and scheduling is determined based on the evapotranspiration requirements of the turfgrass. All turfgrass-soil type combinations will be subjected to two irrigation regimes: 100 percent crop evapotranspiration (ET_c) and 130 percent ET_c.

A lysimeter assembly, consisting of five metal cylinders, was placed in the center of each of the 36 plots. Gravel was placed in the bottom of each lysimeter for drainage. The appropriate soil was then added to the lysimeters. To ensure uniform soil conditions, the soil was hand packed to the same bulk density in each of the barrels.

University of Nebraska
Iowa State University

Pesticide and Fertilizer Fate in Turfgrasses Managed Under Golf Course Conditions in the Midwestern Region - Dr. Garald E. Horst and Dr. Nick E. Christians

The objective of this research is to determine the influence of pesticide, fertilizer and irrigation management practices on the persistence and mobility of nitrogen and selected pesticides in turfgrass systems. Soil columns were sampled from the field to monitor pesticide and nitrogen movement. Intact, undisturbed soil columns also are removed from the field and grown in the greenhouse under conditions which simulate the field turf-soil environment. The greenhouse soil columns allow measurement of nitrogen and pesticides in leachate to complete the balance-sheet of their fate in the turfgrass system.

Research sites with established stands of Kentucky bluegrass were selected at the John Seaton Anderson Turfgrass Research Facility near Mead, Nebraska, and at the Iowa State University Horticulture Farm, Ames, Iowa. The experimental areas were treated with recommended rates of urea fertilizer, Trimec® (2,4-D, mecoprop and dicamba) and pendimethalin herbicides, isazofos and chlor-

pyrifos insecticides, and the fungicide metalaxyl.

Twenty centimeter diameter turf-soil cores were excavated to a depth of 61 cm from local field environments and transported to the laboratory one week prior to application and approximately 1, 14, 30, 60 and 120 days after application. Four cores were removed on each sampling date at each location. The cores were sectioned into verdure, thatch, mat and multiple soil depths, and then prepared for residue analysis.

Experiments addressing the fate of nitrogen and phosphorus were conducted at Iowa State University. Fourteen soil columns were encased in cement, extracted from the field, and transported to the greenhouse. Nitrogen and phosphorus were applied to the columns and two watering regimes of 2.54 cm (1 inch) immediately following nutrient application and four 0.63 cm (0.25 inches) applications during a one-week period were used to determine the effects of irrigation rates on nitrogen volatilization and movement through the turf/soil profile.

Washington State University

Quantification and Fate of Nitrogen from Amended Sand Putting Green Profiles - Dr. Stanton E. Brauen and Dr. Gwen K. Stahnke

The Pacific Northwest has a history of constructing sand greens from pure sand, some with coarse particle sizes and without amendment, to reduce the cost of construction. A major concern is whether nitrate nitrogen leaching from putting green profiles constructed of sand alone, or peat/soil amended sand, can be prevented through efficient irrigation practices, efficient nitrogen fertilizer application, reduction in total nitrogen fertilization rate, or use of deeper sand profiles. This research project will evaluate the susceptibility of these systems to nitrate nitrogen leaching and provide guidance for its correction, reduction or elimination.

Lysimeters were constructed during 1991 from local funds and labor. Thirty-six of the 1.2 m x 2.5 m (4 ft. x 8 ft.) lysimeters were seeded to creeping bentgrass in early October and were overseeded to local ecotypes of annual bluegrass in the spring of 1992. The turf is managed as a putting green and traffic is applied with a Brinkman traffic simulator equipped with golf cleats.

The growing medium consists of 30 cm (12 inches) of USGA specification sand, either alone or amended with ten percent sphagnum peat and two percent fine sandy loam soil. The three annual nitrogen application rates are 195, 390, and 585 kg ha^{-1} yr^{-1} (174, 348, and 526 lbs. per A respectively) and two application methods (granular slow release/soluble N fertilizer in four-week applications and biweekly granular slow release N with liquid ammonium sulfate).

Leachate data collection began the last week of October, 1991, with the beginning of fall rains. Soil-water percolate from each lysimeter is monitored and quantified on 24 hour intervals during leachate production periods. Leachate samples are analyzed by nitrate and ammonium ion sensitive electrodes and ion analyzer.

University of Nevada, Reno

The Effect of Salinity on Nitrate Leaching from Turfgrass - Dr. Daniel C. Bowman, Dr. Dale A. Devitt, and Dr. Wally W. Miller

This project was initiated in March of 1991, and has a field (Las Vegas) and greenhouse (Reno) component to examine the effects of saline irrigation water on nitrate leaching from a soil root zone and on nitrogen uptake by turfgrasses.

Las Vegas: The irrigation system and sampling hardware (lysimeters, tensiometers, neutron probe access tubes, ceramic extraction cups, and associated plumbing) were installed at Horseman's Park in southeast Las Vegas during the spring and summer. Plots were then seeded with either 'NuMex Sahara' bermudagrass or 'Monarch' tall fescue at rates of 50 and 393 kg ha^{-1} (45 and 350 lbs. per A), respectively. Each turf was established under typical fairway management conditions. Bermudagrass plots were overseeded with Palmer/Prelude perennial ryegrass in October. The saline irrigation treatments were initiated in January 1992, after which data collection began.

Reno: Seventy-two 15 cm (6 inches) diameter by 61 cm (24 inches) deep soil columns were equipped with ceramic extraction cups embedded in diatomaceous earth and back filled with a loamy sand. Each extraction cup is connected by tubing to individual collection bottles, which are in turn connected to a common vacuum line. The 36 columns then were seeded with either 'NuMex Sahara' bermudagrass or 'Monarch' tall fescue at the rates discussed above. Establishment and growth was rapid in the greenhouse for both species, and a dense sward has developed. Columns were