leaching potential of the soil (Owosso sandy loam) used in this study.

The project consists of three separate areas. First, the leaching of nitrate from late-fall versus early spring applications will be studied using ^{15}N labeled urea. This study will also examine the fate of nitrogen over a three year period and will focus on the cycling and forms of nitrogen in the soil. As a second approach to the study, pesticides will be applied to the lysimeters and leachate will be tested for the presence of these pesticides over the next three years. A total of five fungicides, two herbicides, and one insecticide will be applied. In August, the insecticide isazofos and the fungicide chorothalonil were applied to the lysimeters, and in September, the herbicides 2,4-D and mecoprop were applied. The other four fungicides will be applied in 1992.

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 will collect samples from recently constructed greens throughout the USA, 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.

Results from our first summer of monitoring are not available at this time due to the intensive nature of the laboratory analysis required to determine ^{15}N quantities. Preliminary data on the quantity of leachate is interesting since it demonstrates that under periods of high ET demand, little leaching occurs. From May 1 through August 28, the lysimeters received a total of 24 inches of rainfall plus irrigation. Only 1.6 inches of leachate, however, were collected from the lysimeters. From August 29 through September 16, an additional 3.1 inches of rainfall plus irrigation were received while the lysimeters leached 1.9 inches of water. Thus, as ET demand decreases, the soil moisture level throughout the whole core rises and rain or irrigation will cause leaching. These data indicate the importance of irrigation management to reduce the potential for leaching. Data will be available in 1992 on the ^{15}N and pesticide content of the leachate and data on the cycling and movement of ^{15}N through soil.

Dr. Bruce Branham

University of California, Riverside

The Fate of Pesticides and Fertilizers in a Turfgrass Environment

The purpose of this research project is to study the fate of pesticides and fertilizers applied to turfgrass in an environment which closely resembles golf course conditions. The goal is to obtain information on management practices that will result in healthy, high quality turfgrass while minimizing detrimental environmental impacts. The specific objectives of the project are to: 1) compare the leaching characteristics of pesticides and fertilizers applied to two turfgrasses; 2) study the effects of the 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 since application; and 5) monitor the effects of different irrigation regimes, fertilizers, and soil types on turfgrass quality.

During the first six months of this research project, a considerable amount of progress has been made on site construction. The site consists of 36 plots, each of which measures 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. A lysimeter assembly, consisting of five metal cylinders, was placed in the center of each of the 36 plots. The lysimeter assembly and drain system has been fabricated using only metal so that there is no potential for pesticide adsorption. Gravel was placed in the bottom of each lysimeter for drainage. The appropriate soil was then added to the lysimeters. In order to ensure uniform soil conditions, the soil was hand packed to the same bulk density in each of the barrels. This was accomplished by weighing the soil and adding it to a measured depth of the lysimeter.

The soil used in the green area is a Caltega IV green sand containing 10 percent sphagnum peat that meets the USGA specifications. 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 the native soil at the site, a fine sandy loam. The other soil is a fine sand that has been brought to the site. The irrigation system is being designed so that each of the 36 plots can be irrigated individually. The irrigation will be controlled electronically; scheduling will be 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.

Fertilizer (urea and sulfur-coated urea) and pesticide treatments will begin early 1992. The volatilization and leaching of the products applied will be characterized for the putting green and fairway plots.

Dr. Marylynn Yates

University of Nebraska
Iowa State University

Pesticide and Fertilizer Fate in Turfgrasses Managed Under Golf Course Conditions in the Midwestern Region

Research addressing movement and fate of fertilizer and pesticides in turfgrasses managed under golf course conditions was initiated at the University of Nebraska and Iowa State University during 1991. The objective of the 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. Intact, undisturbed soil columns were used to reliably monitor pesticide and nitrogen movement in the field, and effectively simulate the turf-soil environment in controlled greenhouse studies. The columns in controlled greenhouse studies will allow measurement of nitrogen and pesticide residue in column leachate for a 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 at the Agricultural Research and Development Center 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 chlorpyrifos insecticides; and the fungicide metalaxyl.

Eight-inch turf-soil cores were excavated to a depth of 24 inches 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. Additional untreated soil columns were encased in cement before being moved to the greenhouse for controlled experiments.

Experiments addressing the fate of nitrogen and phosphorus were initiated 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 (1 inch immediately following nutrient application and four 0.25-inch applications during a one-week period) were used to determine the effects of irrigation rates. Nitrogen volatilization was greater from columns receiving the lower irrigation rate. Nitrogen moved to greater depths in the profile under the higher irrigation rate.

Protocols developed at Iowa State for soil column preparation and greenhouse research were modified for pesticide and fertilizer studies at the University of Nebraska. A concern regarding the effect of cement encasement on soil pH was addressed. The pH of a Sharpsburg soil increased from 6.0 to 6.7 after 10 days of contact with the cement, but declined and remained between 6.2 and 6.5 at 15 to 45 days after encasement. The pH fluctuation would not be expected to have a significant effect on the fate of the pesticides included in the study. In addition, a porous plate assembly was designed and constructed such that soil water tension found in the field could be simulated in the greenhouse.

An analytical procedure for simultaneous extraction and quantification of residues of isazofos, metalaxyl, chlorpyrifos and pendimethalin has been developed, and analysis of turf/soil cores removed from the Nebraska and Iowa field sites is in progress. Additional methodology development will be required for analysis of 2,4-D, dicamba and mecoprop in the samples.

Dr. Garald Horst
Dr. Nick Christians