



## **WATER RESOURCES RESEARCH GRANT PROPOSAL**

**Title:** Validation of Soil Leaching Computer Simulation Models to Manage Nitrate Pollution in a Shallow, Calcareous Soil, Continuing Project.

**Duration:** September, 1997 to August, 1998

**Fiscal Year 1997 Federal Funds:** \$39,883

**Non-Federal Funds Allocated:** N/A

### **Principal Investigators:**

Peter Motavalli, Assistant Professor of Soil Science, College of Agriculture and Life Sciences, University of Guam, Mangilao, GU 96923

Prem Singh, Assistant Professor of Agricultural Engineering, College of Agriculture and Life Sciences, University of Guam, Mangilao, GU 96923

Jacob Kuhn, Resource Conservationist, Natural Resources Conservation Service, Pacific Basin Area, U.S. Department of Agriculture, Maite, GU 96927

**Congressional District of University Performing the Research:** N/A

### **Statement of the Critical Regional or State Problem:**

Increasing development of land overlying freshwater limestone aquifers on Guam and other islands in Micronesia has raised concerns over the potential risk of nitrate pollution of groundwater. The Natural Resources Conservation Service is coordinating a Northern Guam Watershed Plan to promote agricultural best management practices and assist land use planners in this region of Guam. The naturally shallow and well-drained soil cover overlying the limestone aquifer increases the rate at which nitrates and other potential pollutants can enter groundwater. Relatively little information is available on the impact of agricultural practices in Micronesia on nitrate pollution. Moreover, no estimates are currently available on the total amount of nitrogen fertilizer and organic materials applied, the total amount of nitrogen removed in agricultural products, and the total amount of nitrogen lost through leaching and other loss mechanisms. This information together with a computer simulation model, which could predict nitrate leaching based on agricultural management practices, would assist in assessing potential environmental impacts of different land use and cultural practices in the Northern Guam Watershed and similar watersheds in other islands of Micronesia.

The first year (FY 1995) of this project has provided baseline information on the effects of soil physical properties, nitrogen source, and plant growth on nitrate movement. Second year (FY 1996) research has established a field experiment which will provide

data on the effects of nitrogen fertilizer rates and levels of irrigation on nitrate leaching and will be used in examining the effects of adding organic materials, such as animal manure, in the future. In the third year (proposed FY 1997), this data will be utilized for initially validating and comparing two soil nitrate leaching simulation models (LEACHN and 2D SOIL). Based on information collected from a farmer survey on present N fertilizer and organic material applications and management practices, predictions based on simulations of nitrate leaching will also be developed for the Northern Guam Watershed.

**Statement of the Results and Benefits of the Information Expected:**

Consideration of the environmental impact of agricultural land use in Northern Guam has been limited due to a lack of baseline information on current fertilizer use and the effects of agricultural management and environmental factors on nitrate leaching into groundwater. Validation of a nitrate leaching simulation model for the environmental conditions of Northern Guam could be a useful predictive tool for land use planners. The shallow, calcareous soil that underlies much of Northern Guam is similar to soils in other islands in Micronesia which are dominated by limestone. Our long-range objective is to link the soil-based nitrate leaching simulation models with a hydrological simulation model to predict potential groundwater contamination. In addition, the experience in validating the soil leaching models for nitrate may be useful for validating such models for other potential contaminants of groundwater.