

USE OF SLOW-RELEASE N FERTILIZER TO CONTROL NITROGEN LOSSES DUE TO SPATIAL AND CLIMATIC DIFFERENCES IN SOIL MOISTURE CONDITIONS AND DRAINAGE IN CLAYPAN SOILS

Sara Merchán Paniagua

Dr. Peter P. Motavalli, Thesis Supervisor

ABSTRACT

Agricultural soils are a major source of nitrous oxide (N_2O) which has a significant environmental impact on global warming and ozone depletion. However, there is little information on soil N_2O emissions under different drainage and irrigation treatments in claypan soils. The objectives of this research were to determine the relationship between soil N_2O efflux, temperature, soil NO_3^- -N, and soil water content and to examine the performance of polymer-coated urea (PCU) compared to conventional urea in relation to crop N uptake and environmental N loss under four drainage/irrigation treatments in a claypan soil in northeast Missouri. The treatments consisted of: 1) no irrigation or drainage (NIN), 2) no irrigation and drainage (NID), 3) subirrigation and drainage (SUB), and 4) overhead irrigation and no drainage (OND). The plots were split into N fertilizer treatments of pre-plant-applied conventional urea or polymer-coated urea at rates of 0, 140, and 280 kg N ha⁻¹.

At the beginning of 2004, significantly lower soil N_2O flux was measured with application of PCU under NIN and OND. However, no consistent differences in soil N_2O efflux between fertilizers were observed in 2005, probably due to the lower precipitation that year. Higher NO_3^- -N concentrations were observed under application of urea at the beginning of the 2004 growing season. In contrast, PCU led to higher NO_3^- -N concentration later in the growing season. No differences were observed between fertilizers. The results of this study suggest that PCU may be effective in reducing environmental N losses under wet conditions early in the growing season.