RELEASE OF NITRATE-NITROGEN AND HEAVY METALS FROM LAND APPLIED BIOSOLIDS IN NORTHERN AREAS

Principal Investigators: Dr. George Estes, Jianqiang Zhao and Nancy Batchelder, University of New Hampshire

Descriptors: Land application, sludge, ground water, soil water, nutrients, crop yield

Problem and Research Objectives:

The research involves on-farm, field-scale studies with biosolids from Concord and Hanover, NH, and is designed to identify best management strategies for their appropriate use when applied to agricultural land. The specific objectives for this research were: (1) to determine the relationship between N loading rates, nitrate-N production and changes in NO3 - N concentrations of soil profiles at four rates of broadcast, soil-incorporated biosolids; (2) to identify the extent of nutrients and metal accumulation and mobility within soil profiles, uptake by crops, and their movement beyond the root zone at four application rates of biosolids.

Principal Findings and Significance:

Biosolid application has produced negligible improvements in crop yield due to a high degree of residual fertility in the soil at both sites. At Site 2, no statistically significant differences occurred in yield of silage corn for 1993, but in 1994 significant yield increases (over controls) were noted with Concord biosolids at the highest rates. At Site 1, no significant yield increases occurred in either 1993 or 1994 (compared to controls) following application of biosolids or manure. No significant change occurred in the concentration of heavy metals in plant tissue following soil incorporation of biosolids at either site. Metals were concentrated in the zone of incorporation (0-6") of the soil profile.

Seasonal soil NO3 -N levels at Site 2 as measured via PSNT tests showed a peak release in early August from biosolids, which was not synchronous with the N needs of corn.

Concentrations of NO3 -N in water samples collected by suction lysimeters located 4 feet below the soil surface were higher with biosolids compared to manure at comparable rates of total N application. While highly variable, NO3 -N concentrations from these lysimeters frequently exceeded federal drinking water standards of 10 ug g-1 . Monitoring wells installed in the summer of 1995 at Site 2 showed a fluctuating water table in June-July which varies from 13 to 14 feet; water samples collected from these wells showed NO3 -N concentrations to vary from 0.2 - 12 ug g-1 .