Distribution and Fate of Nitrate in Shallow Ground Water of Citrus Farming Areas, Indian River, Martin, and St. Lucie Counties, Florida

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The surficial aquifer system beneath citrus farming areas in Indian River, Martin, and St. Lucie Counties, Florida was investigated to detect impacts of citrus agriculture on shallow ground-water quality. Six citrus grove sites and one reference site were selected based on representative agricultural practices, soils, and tree age and health. Water-quality samples were collected and analyzed and water-level data were measured from 1996 through 1998. Elevated chloride and dissolved solid concentrations (indicators of agricultural influence) were found in ground water from citrus sites. The median chloride and dissolved-solids concentration in samples from citrus sites was 130 milligrams per liter (mg/L) and 796 mg/L, respectively. Median chloride and dissolved-solids concentrations in samples from the reference site were 23 mg/L and 171 mg/L. Nitrate concentrations in ground water exceeded the maximum contaminant level (MCL) for nitrate as established by the U.S. Environmental Protection Agency in only five percent of samples. These exceedances came from wells with depths of 10 feet or less at citrus sites and mostly from samples collected during or immediately following heavy fertilizer application. Samples from deeper wells contained little or no nitrate.

Conditions in the aquifer indicate that denitrification was primarily responsible for the reduction of nitrate in ground water. Organic carbon and iron concentrations (medians of 35 mg/L and 2.1 mg/L, respectively) were high, and dissolved-oxygen concentrations were low (generally less than 0.9 mg/L). Ground water from wells 10 to 15 feet in depth was enriched in $\delta\,^{15}N$ (median 25.5 per mil) indicating that fractionation occurred as a result of denitrification. Fertilizer samples had a median $\delta\,^{15}N$ of 3.0 per mil. Excess nitrogen gas (produced during denitrification) was extracted from ground water in wells 10 to 25 feet in depth; concentrations ranged from 1.7 to 8.3 mg/L.

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