Iowa Update

AGRICULTURAL IMPACT ON GROUNDWATER QUALITY

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There has been an increasing awareness within Iowa of the impact of agriculture on groundwater quality. The data of Iowa Geologic Survey scientists from studies in northeast Iowa have focused attention on the Big Spring Basin area. A project to intensively study groundwater in the Big Spring Basin is underway. The project includes the active cooperation and participation of the following agencies: ISU Agricultural Experiment Station, Clayton County Soil Conservancy District, ISU Cooperative Extension, ISU Department of Agronomy, U of I Institute of Agricultural Medicine, Iowa Conservation Commission, Iowa Department of Soil Conservation, Iowa Department of Water, Air, and Waste Management, Iowa Geologic Survey, Northeast Iowa Conservancy District, U of I University Hygenic Laboratory, U.S. Agricultural Stabilization and Conservation Service, U.S. Environmental Protection Agency, U.S. Geologic Survey, U.S. Soil Conservation Service, and the Iowa Fertilizer and Ag Chemical Dealers Association. The entire project is projected to cost $6.8 million. Currently $2.6 million has been secured.

BIG SPRING BASIN

Farmers in Big Spring Basin were surveyed in 1984 (Padgitt, 1984) and again in 1986 to determine their management practices. The 1984 survey found that, on the average, N fertilizer was being applied at rates 50 lb/a in excess of that required to produce current yields. Failure to account for the nutrient value of animal manures and alfalfa was cited as the apparent reason for over-applications.

The 1986 survey indicates that average N rates for continuous corn are 15 to 20 lb/a less than in 1984. Forty percent of the farmers said they had reduced rates since 1984. Also, farmers are now taking into account the nutrient value of animal manure and previous crops. Two thirds of the farmers in the basin indicated the benefits of doing so outweighed the costs.

Monitoring of water in the Big Spring Basin is continuing. Several studies have been initiated in the basin to monitor the affects of modifying chemical management on groundwater quality. Several demonstration projects are underway to demonstrate the nutrient value of animal manure and legumes. A demonstration involving an entire sub-basin is pending that will involve different fertilizer and manure management approaches along with several soil conservation methods. The affect of these practices on water quality will be measured.

With all attention focused on Big Spring Basin, there has been a tendency to assume that groundwater elsewhere in the state is not contaminated. Recent studies by Iowa Geologic Survey scientists and scientists at the State Hygenic Lab at the University of Iowa indicate this is not true. In fact, agricultural chemicals including nitrate and several pesticides have been detected in ground water at numerous sites in Iowa (Hallberg, 1986).

NITRATE

Nitrate, at concentrations exceeding the maximum contaminant level of 10 mg/l NO_3-N (45 mg/l NO_3), has been found in several public drinking water

systems throughout Iowa since 1980 (Figure 1). The NO_3 level in numerous aquifers in Iowa is being sytematically monitored by Iowa Geological Survey scientists. Their data show that NO_3 concentration generally decreases with increasing depth below the land surface (Figure 2 and 3). Studies summarized by Hallberg (1986) indicate that the NO_3 is leaching through the soil and infiltrating to the shallow groundwater.

PESTICIDES

Hallberg (1986) states that modern pesticides have been detected in groundwater in virtually all parts of Iowa (Figure 4). The concentrations are low (Table 1), however, the EPA has not established "safe" limits for some of the pesticides detected.

Although there are few data on pesticides in groundwater, data from the Big Spring Study indicate that their concentration has been increasing steadily since monitoring began in 1982 (Figure 5). The concentration of DDT has been decreasing since its use was banned.

SUMMARY

The quality of groundwater in Iowa is becoming of increasing concern to all in the state. Nitrate, at concentrations exceeding established "critical" levels, has been detected at numerous locations in the state. Several pesticides have also been detected in public drinking supplies as well as in some shallow groundwater aquifers. The presence of the chemicals is alarming in itself. More alarming is that the concentrations of virtually all detected chemicals appear to be increasing with time.

REFERENCES

Hallberg, G. R. 1986. Agricultural chemicals and groundwater quality in Iowa: Status report 1985. Proc. 38th Fert. and Ag. Chem. Dealers Conf. Jan 14-15, 1986. ISU Coop. Ext. Ser. CE 2158q.

Hallberg, G. R. and B. E. Hoyer. 1982. Sinkholes, hydrogeology, and groundwater quality in northeast Iowa. Ia. Geol. Surv. Open-file Rept. 82-3.

Hallberg, G. R., R. D. Libra, E. A. Bettis, III, and B. E. Hoyer. 1984. Hydrogeologic and water quality investigation in the Big Spring Basin, Clayton County, Iowa. 1983 water year. Ia. Geol. Surv. Open-file Rept. 84-4.

Hunt, P. K. B. and D. L. Runkle. 1985. Groundwater data for the alluvial, buried channel, basal Pleistocene, and Dakota aquifer in west-central Iowa. U. S. Geol. Surv. Open-file Rept. 84-819.

Padgitt, S. 1985. Farming operations and practices in Big Spring Basin. Iowa State Univ. Coop. Ext. Ser. CRD 229.

Table 1. Maximum pesticide concentrations detected in groundwater from alluvial/Pleistocene aquifers in Iowa. Data from DWAWM, IGS, USGS, UHL sampling.

Common name active ingredient	Typical trade name	Maximum concentrations µg/l
Herbicides		
atrazine	AAtrex, Atrazine	3.0
alachlor	Lasso	0.7
cyanazine	Bladex	1.4
metolachlor	Dual	4.5
metribuzin	Sencor/Lexone	0.8
chloramben	Amiben	1.7
dicamba	Banvel	2.3
Insecticides		
fonofos	Dyfonate	0.9

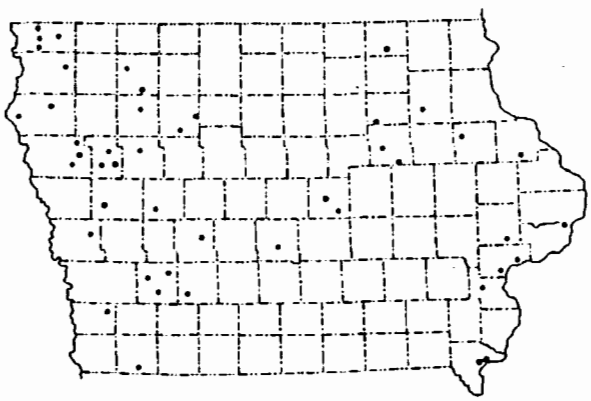

Figure 1. Public water supplies that have exceeded the nitrate "maximum contaminant level," of 10 mg/l NO_3-N (45 mg/l NO_3) since 1980. Data from Iowa Dept. of Water, Air, and Waste Management (R. Kelley, pers. commun.).

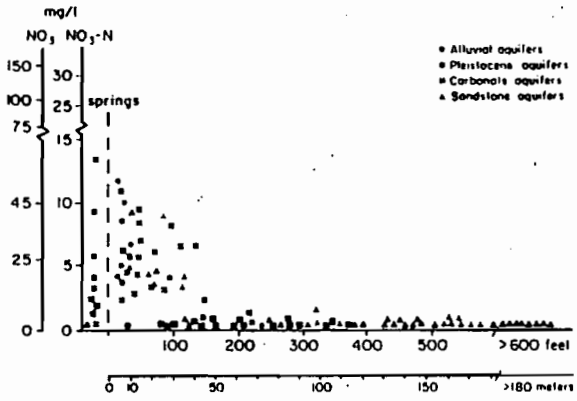

Figure 2. NO_3-N concentrations in groundwater versus depth to groundwater tapped by well, from northeast Iowa; depth represents casing depth or well depth, where casing depth approximates total well depth (data from Hallberg and Hoyer 1982; Hallberg et al., 1984).

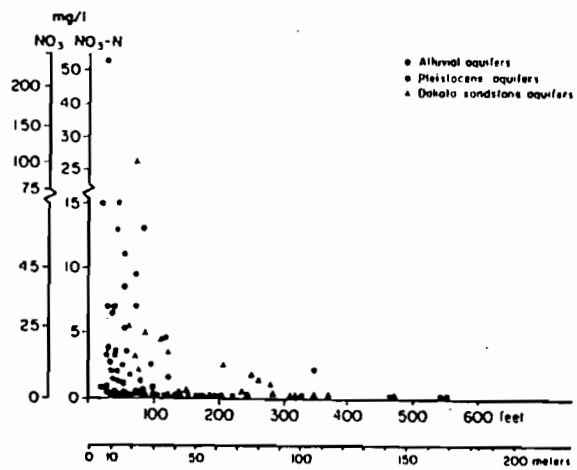

Figure 3. NO_3-N concentration in groundwater in relation to depth, as in figure 2; data from west central Iowa (data from Hunt and Runkle 1985).

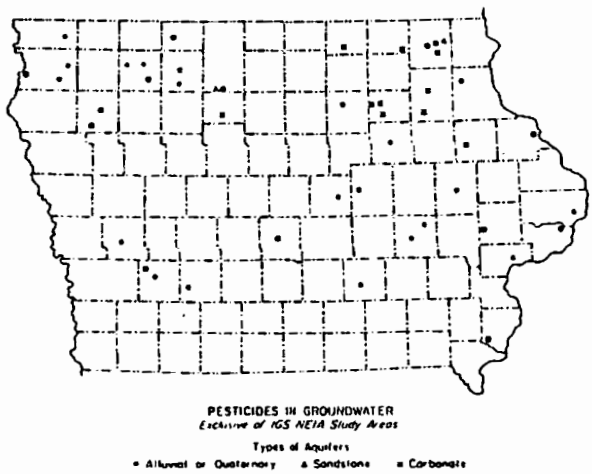

Figure 4. Map showing locations where pesticides have been detected in groundwater, *exclusive* of IGS studies in northeast Iowa. (Data compiled from Kelley, 1985; Musterman, 1981; other IGS data; and unpublished data from DWAWM, R. Kelley, pers. commun.; USGS, M. DeTroy, pers. commun.; and UHL, R. Spinter, L. Johnson pers. commun.).

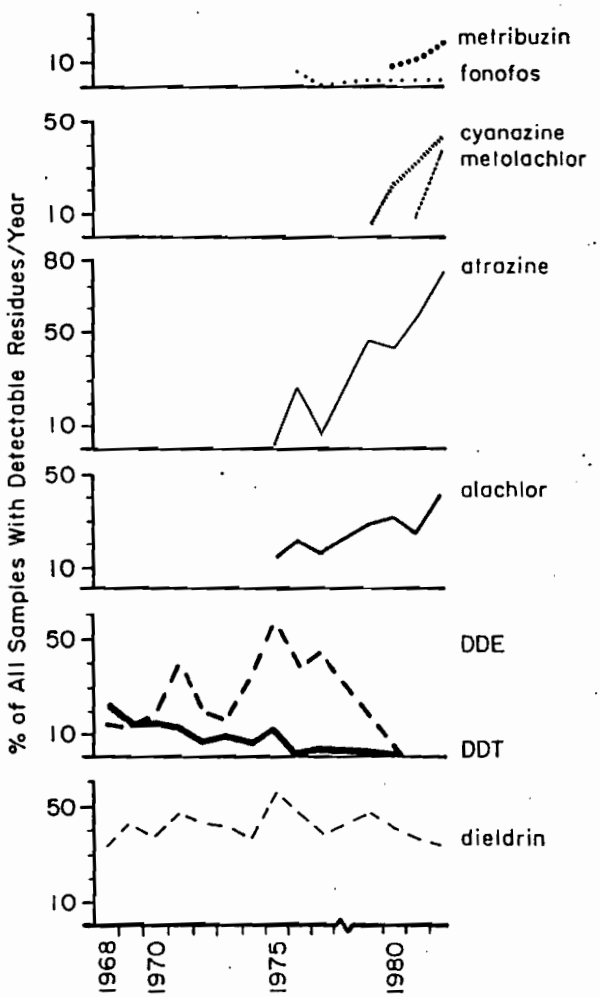

Figure 5. Percent of all samples per year, from monthly sampling of 12 surfacewater sites that had detectable pesticide residues, versus time (Data from R. Splinter and L. Johnson, UHL, pers. commun.).

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