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CLEAN WATER

Everybody's Concern

Herman Rosholt Water Quality Research Farm

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HERMAN ROSHOLT WATER QUALITY RESEARCH FARM

HISTORY AND BACKGROUND

In 1967, a two-year study of the extent of surficial aquifers by the U.S. Geological Survey was funded.* The purpose of this study was to determine water availability for irrigation.

Funding for the study came when West Central Minnesota Resource Conservation and Development Association (WesMin RC & D) raised one-half the total $44,000 cost and the Minnesota legislature appropriated $10,400 to aid the effort: Soil and Water Conservation Districts (SWCD's) from Kandiyohi, Pope, and Stearns counties contributed a total of $4500, which was combined with a portion of the state funds. An irrigation research farm was ready to be established.

A local coordinating committee purchased 40 acres on the outskirts of Westport in northeastern Pope County. Later the Pope County SWCD bought out the other two counties, and named the tract "Bonanza Valley-Herman Rosholt Irrigation Research Farm." (See Figure 1 for location of farm.)

**Note: Surficial aquifers are water-bearing body of rock or unconsolidated particles. The surficial aquifers consist of sand and gravel deposits. Water can be withdrawn from the pore space in these deposits. The water contained in aquifers is called "ground water".*

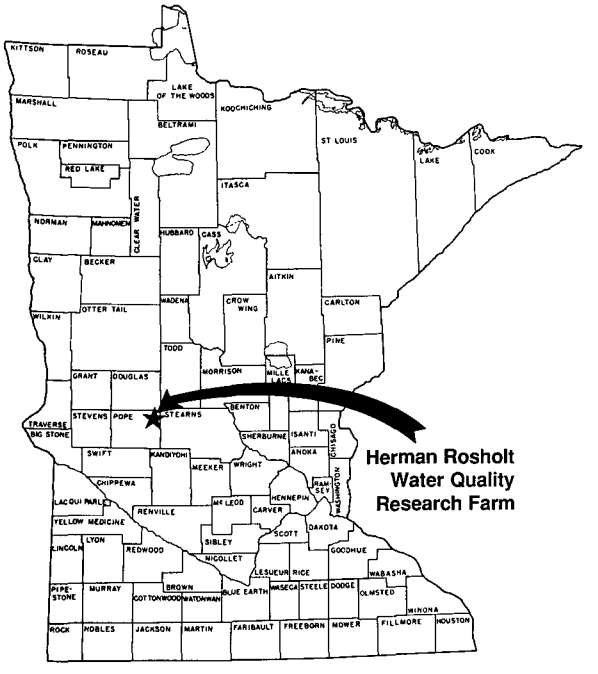

Figure 1. Location of Rosholt Water Quality Research Farm

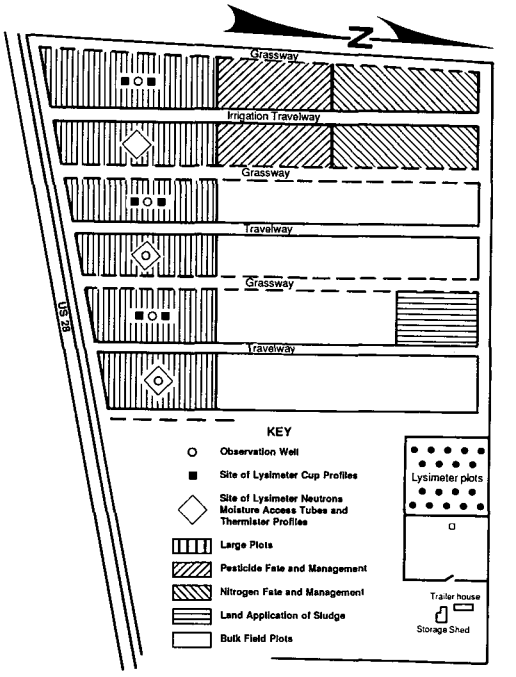

Figure 2. Research Plot Locations and Farm Layout

By 1983, with increasing concerns about the impact of agricultural management practices--and their effect on groundwater quality-- another joint funding agreement was proposed to the U.S. Geological Survey to carry out a well water monitoring program. A three-year study of 190 irrigation wells confirmed the need to research the movement of agricultural chemicals to groundwater in areas of sandy soils and shallow watertables under irrigation.

The Rosholt farm is an excellent research site because of the soils present on the farm. The use of sprinkler irrigation in the WesMin area has increased from 5,000 acres, in 1960, to 200,000 acres with 52,000 acres of that total in the Bonanza Valley.

RESEARCH PROGRAM

Research at the Rosholt farm focuses on the basic behavior of chemicals and nutrients in the environment; practices for responsible management of chemicals; and modeling chemical behavior in the environment. It is not only multi-disciplinary but also multi-agency. All participating agencies and associations of the Farm Steering Committee are involved in the planning with scientists from the University of Minnesota and U.S. Geological Survey. (A site plan map is provided in Figure 2.)

Five major areas of water quality research are being conducted. Major research areas are:

1) water movement in soils and vadose zone
2) nitrogen fate and management
3) pesticide fate and management
4) tillages and movement of agricultural chemicals to groundwater
5) land application of incinerator ash

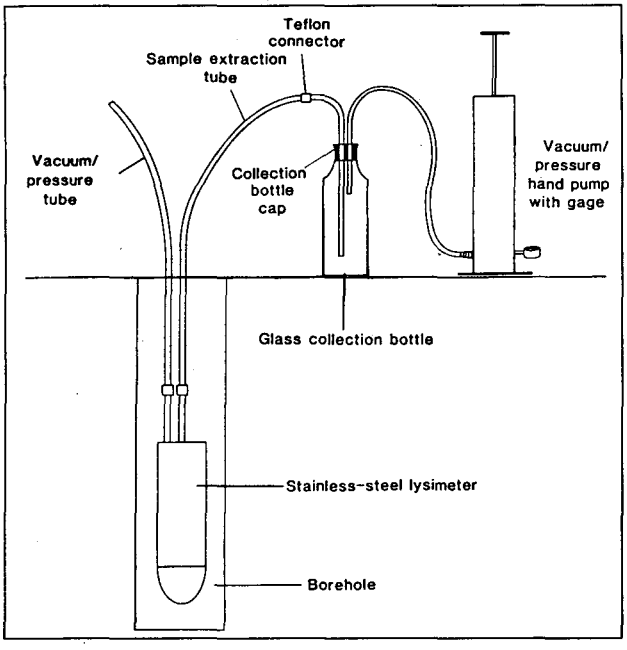

Figure 3. Suction Lysimeter

Water Movement in Soils

In order to understand the impact which agricultural practices have on groundwater quality, it is essential to measure the movement of water and chemicals under the experiment site.

Several methods have been employed at the Westport facility to accomplish this: These include the neutron probe method and the electrical resistance block method. (A neutron probe measures the interaction of radioactively emitted neutrons with water molecules and relates this interaction to the water content of the soil. Electrical resistance blocks operate on the principle that as the water content of the soil decreases the resistance to flow of electrical current in the soil increases.) Methods used for measuring the chemical content of soil water include suction lysimeters zero-tension pan samplers, and wick samplers. (See Figures 3 and 4.)

Nitrogen Fate and Management

Nitrogen research is divided into three phases; each designed to determine the impact of agricutural practices on the transport and accumulation of nitrate-N in the groundwater. The three phases of research include a lysimeter, small plot, and large plot components. The large plot phase of research is being conducted in cooperation with the U.S. Geological Survey.

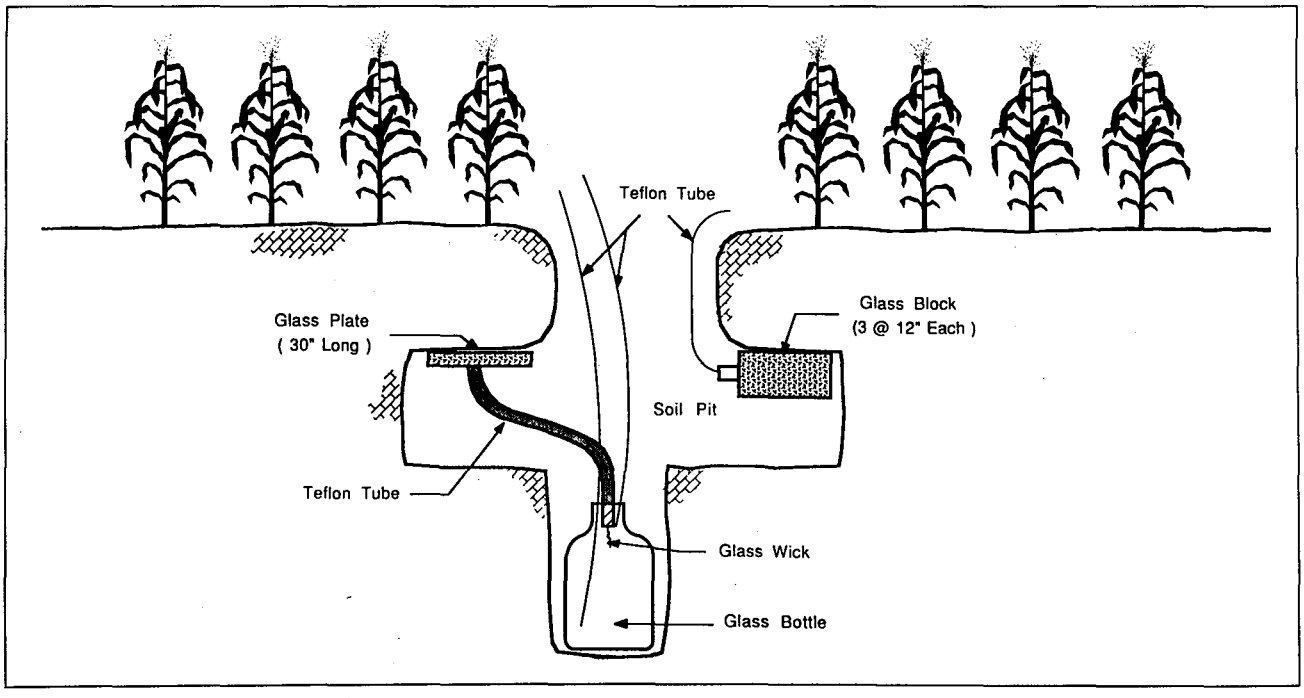

Figure 4. Zero-Tension Pan Sampler

The objectives of nitrogen research studies are to:

1) determine the rate of movement of nitrogen under different tillages and crop rotations
2) quantify the processes that regulate the movement of nitrogen to groundwater
3) develop best management practices to minimize movement to groundwater while maintaining profitability

Pesticide Fate and Management

The objectives of the pesticide research portion of the water quality project are to:

1) determine the movement and rate of dissipation of three chemicals (dicamba, atrazine and alachlor) in three soil types under four tillages
2) determine the development and movement of metabolites of the three chemicals (dicamba, atrazine and alachlor) in three soil types
3) determine the influence of macropores on herbicide movement in soil
4) develop models to predict herbicide movement and validate models with field and laboratory studies
5) develop best management practices that minimize the impact of herbicides on groundwater quality while maintaining an economically profitable enterprise
6) develop new weed control practices that eliminate the use of herbicides

Tillages and Movement of Agricultural Chemicals to Groundwater

The objectives of the study are to:

1) determine how fertilizer application rates, tillage practices and hydrologic conditions affect the concentration of chemicals and other inorganic constituents in the unsaturated zone and in the underlying unconfined-sand aquifer (layer of water)
2) determine the fate and persistence of widely used herbicides and their metabolites in the above areas under typical application conditions
3) provide hydrologic data to assist others in research on degradation and movement of typical herbicides

A ground-water-flow model constructed to represent the unconfined sand and gravel aquifer underlying the Rosholt farm was used to test the sensitivity of aquifer properties, hydrologic boundaries, recharge, and pumping from the well located in the northwest corner of the farm.

Additional wells were installed to evaluate three dimensional movement of nutrients and pesticides in groundwater. Evaluation of these wells will be used to augment data from the 19 wells originally installed in October 1986.

Land Application of Incinerator Ash

Finding an environmentally acceptable disposal method for incinerator ash has become important since there are increasing quantities and types of waste being burned.

Recycling incinerator ash nutrients by landspreading may provide a disposal method that is beneficial to both incinerator operators and crop producers. The purpose of this study is to determine if sewage sludge ash from the Metropolitan Waste Water treatment plant can be used as a source of phosphorus fertilizer without lowering crop quality or degrading the environment.

TECHNOLOGY TRANSFER

Nutrient and Pesticide Standards

As results of this research program are realized, it is important that this knowledge be transferred to individual landowners and managers. Each summer field tours are held to discuss research results. (See Figure 5.)

On the basis of what is known about nutrient and pesticide management and results of current research efforts, standards are being developed. Copies of the standards and specifications will be contained in each Soil Conservation Service Field Office Technical Guides.

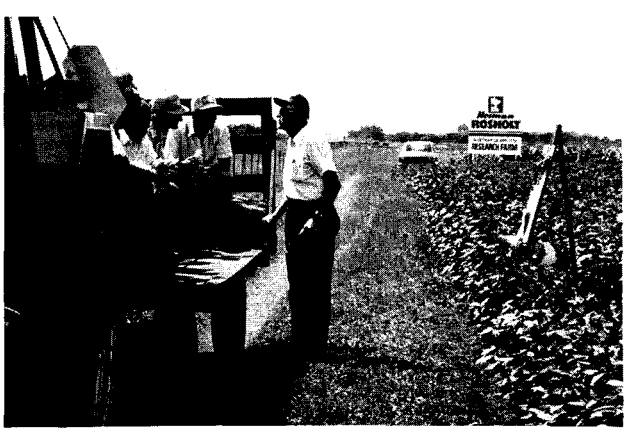

Figure 5. A Summer Field Day

District Conservationists and SWCD employees will use them to work with individual farm and land managers. County and Area Extension Agents will also be able to provide this information.

A computer information system is planned to provide timely information about the use and management of nutrients and pesticides.

CENTER FOR AGRICULTURAL IMPACTS ON WATER QUALITY

To meet the challenges of clean water with a productive agricultural system-- while taking into consideration the diversity of research and educational groups involved with water--a Center for Agricultural Impacts on Water Quality was formed within the College of Agriculture, University of Minnesota.

The Center's objectives include:

1) minimizing groundwater contamination by agricultural chemicals
2) developing and improving managerial procedures that reduce agricultural chemical use
3) increasing our understanding of the behavior and longevity of agricultural chemicals in soil and groundwater systems
4) assessing the social and economic impacts of management practices

The Center also serves as an information headquarters on agriculturally-related water quality issues to legislators, state and federal agencies, education bodies, and the general public and obtains funding for research and education.

Funding for the center is provided through the Minnesota Agricultural Experiment Station. Two years of operating funds for the farm operations were provided by the Legislative Commission on Minnesota Resources (LCMR).

COOPERATING AGENCIES

WesMin RC&D
West Central Minnesota Irrigation Association
Soil and Water Conservation Districts
Soil Conservation Service
U.S. Geological Survey
Agricultural Research Service
Minnesota Agricultural Experiment Station
Minnesota Extension Service

COOPERATING SCIENTISTS

University of Minnesota Center for Agricultural Impacts on Water Quality Steering Committee
Jim Anderson, Director, Department of Soil Science
Bill Easter, Department of Agricultural and Applied Economics
Bill Koskinen, USDA, Agricultural Research Service
Gary Malzer, Department of Soil Science
John Nieber, Department of Agricultural Engineering
Gyles Randall, Southern Experiment Station, Waseca
Don Wyse, Department of Agronomy and Plant Genetics

Others:

Scientists from several disciplines and agencies are involved in the ongoing research program

Bud Anderson, U.S. Geological Survey
Ian Moore, Department of Agricultural Engineering
Carl Rosen, Departments of Soil Science and Horticultural Science & Landscape Architecture
Robert Polta, Metropolitan Waste Control Commission
Jeff Stoner, U.S. Geological Survey
Dave Breitbach, Soil Conservation Service