



Missisquoi Water Quality

Demonstration results from the Lower Missisquoi Water Quality Project in Franklin County, Vermont

Missisquoi Crop Management Association

Crop Management Service Continues As Farmer-Run Crop Management Association

Background

Missisquoi Bay is one of the most eutrophic in Lake Champlain with phosphorus (P) concentrations as high as those in Lake Erie in the 1970's. A significant portion of the P load in this dairy production area has been attributed to runoff from agricultural nonpoint sources such as manure, fertilizer and cropland erosion.

As part of the Lower Missisquoi Water Quality Project, we established a Crop Management Service to develop whole-farm nutrient management plans, which included nutrient, pest, and other crop management services. The goal was to improve management practices, especially for manure and fertilizer; to reduce the potential for environmental impact; and to increase the farmers' economic return. Between 10 and 14 farmers enrolled a total of up to 1,700 acres of cropland each year of the program (Table 1).

Table 1. Yearly summary of number of farms and acreage enrolled in the Missisquoi Crop Management Service. 1991-1994.

Year	# Farms	Crop			Total
		Corn	Legume	Grass	
		acres			
1991	10	511	383	493	1386
1992	12	566	559	459	1584
1993	14	462	456	812	1731
1994	10	478	536	710	1725

Services

The services provided varied with the crop, as follows:

Nutrient Management Package (all crops)

- Fall soil sampling and analysis
- Manure sampling and analysis
- Nutrient management planning
- Fertilizer recommendations
- Pre-sidedress Nitrate Test for corn (sampling and analysis)
- Computerized crop record keeping

Corn Pest Management Package

- Spring weed assessment
- Population count
- Scouting through season of insect pests
- Fall weed assessment
- Pest management planning and recommendations

Alfalfa Management Package

- Winter injury assessment
- Spring crown count
- Scouting through season of insect pests
- Fall crown count
- Pest management planning and recommendations

Grass, Clover and Pasture Management

- Species assessment

The Vermont computerized crop recordkeeping system, Vermont CropMD (Web: <http://pss.uvm.edu/vtcrops/Articles/CropDB.htm>) was used by the farmers to monitor crop inputs, manure applications, yields, weeds and pest problems, costs and returns. Participants received an Input Booklet at the beginning of each cropping season for recording information and returned it at the end of the season for entry into a computer database. Computer-generated summary reports were made for each farm and included comprehensive data by field and by crop. These summaries were then used by the farmer and the Integrated Crop Management (ICM) consultant to make management decisions for the next cropping season.

Nutrient Management Planning

A key element of the Crop Management Service was the development of nutrient recommendations for individual fields on each farm. The ideal is to have soils that have adequate nutrient levels to support good crop production but not excessive levels that have

a greater potential for adverse impact on water quality. To these ends, each field on each of the cooperating farms was soil sampled annually, usually in the fall, for routine soil testing of pH, K, Mg, Al, and available and reserve P. Corn fields were sampled for nitrate in the summer, as well. Soil test results were combined with crop and soil information and manure analysis and management information to make manure and fertilizer recommendations using UVM Nutrient Recommendations (Web: <http://ctr.uvm.edu/pubs/nutrientrec/>) and the Vermont Manure Nutrient Manager, a computer spreadsheet template (Web: <http://pss.uvm.edu/vtcrops/Articles/ManMgrSprdsht.html#top>).

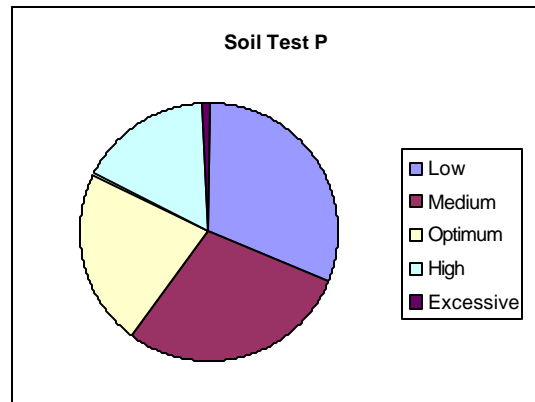


Fig. 1. Available soil test P distribution on Crop Management Service farms. 1993.

Soil test results varied greatly on individual fields. For example, in 1993 over half of the fields were medium to optimum in available phosphorus, about a fourth were low to very low, and the remaining 20% were high to excessive (Fig. 1). Almost all farms have some fields higher than optimum (high or excessive), which means they need no additional P for crop production and pose a potential problem for surface water quality. But most farms also have some fields with lower than optimum P soil test levels, indicating a need for additional manure or fertilizer P to maintain crop yields (Fig. 2). Results of the Pre-sidedress Nitrate Soil Test (PSNT) for corn showed a large range in nitrate test levels among individual fields, as well as differences in overall average values for different years. Several cooperators saved N fertilizer expense and reduced the potential for nitrate pollution of surface and groundwater through use of the PSNT. These results point out the critical importance of soil testing to indicate those fields that need little or no additional fertilizer to maintain top yields and those that require additional amounts to maintain top productivity.

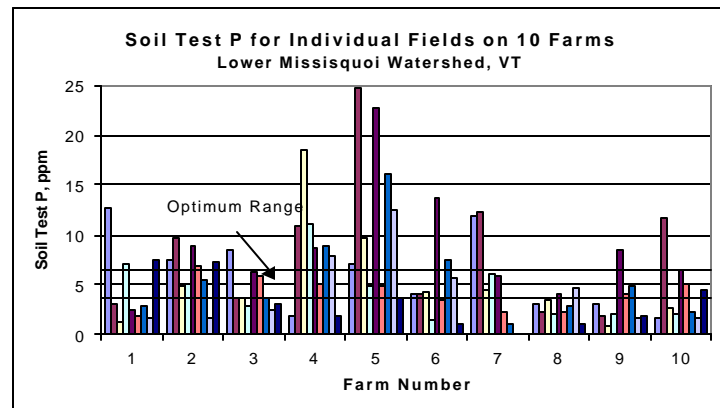


Fig. 2. Soil test P (modified Morgans extract) on 10 farms (10 fields per farm) in Crop Management Service. 1993.

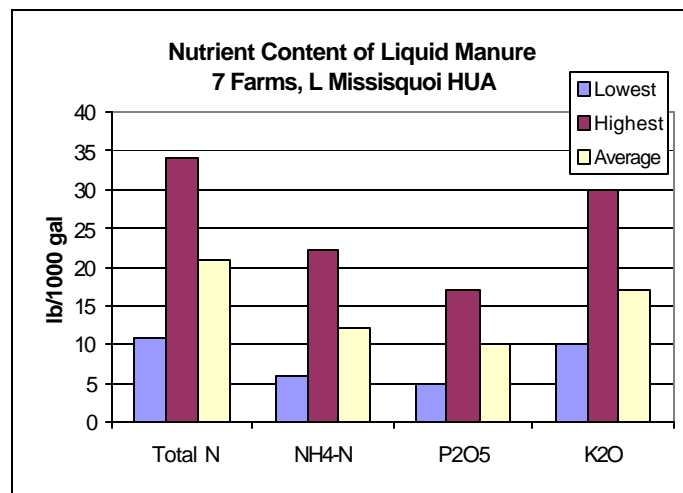


Fig. 3. Nutrient content of liquid manure on 7 dairy farms. 1993.

Manure sampling was done, as part of the nutrient management package, to assess the nutrient contribution from manure and to avoid excessive applications. Manure was sampled at least annually on all farms on the program, either by the farmer or by the project technician. Considerable variation occurred among farms -- as much as a two-fold difference in nutrient content of manure from different farms -- which points out the importance of basing recommendations on nutrient analysis rather than on standard estimates (Fig. 3). This is particularly important in watersheds such as the Missisquoi where two-thirds of the phosphorus applied to cropland comes from manure.

Recommended vs. Applied Nutrients: Environmental and Economic Impacts

To evaluate how well farmers were following our manure and fertilizer recommendations, we used information from the crop recordkeeping system to compare rates actually applied to those recommended. In 1993 application rates of phosphorus were within 20 lbs P_2O_5 /acre of the recommended rate on about 75 percent of all crop acreage. Nitrogen fertilizer was applied to corn at rates recommended by the PSNT (+/- 20 lb/acre) on 80 percent of the acreage, the average rate being within 5 lb/acre of the recommended rate. This appears to indicate fairly good acceptance of a nitrogen test that, on average, recommends less than conventional recommendation methods.

Following recommendations gave positive economic and environmental results for participating farmers. Overall, there was a significant reduction in the use of commercial fertilizer after the farms enrolled in the crop management service, based on a study of seven farms in the project (Knight et al., 1997). Phosphorus use decreased by an average of 40 percent and potassium by 29 percent over a 3-year period. Also, farmers changed their timing of nitrogen application in ways that increase the availability to the crop and decrease losses to the environment. The farms in the study reduced total expenses by an average of \$27/ acre, while crop yields remained constant.

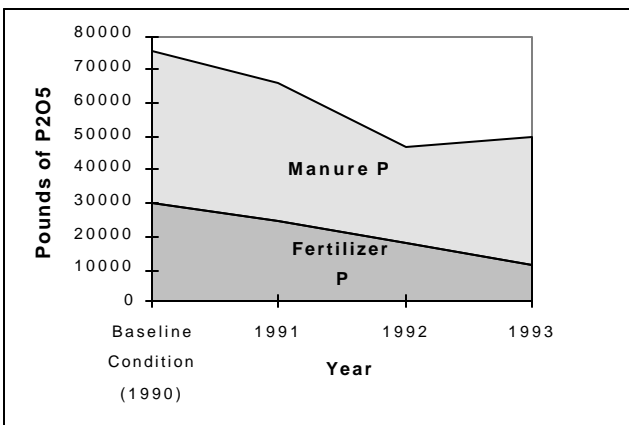


Fig. 4. Total amounts of manure and fertilizer P applied on seven dairy farms. 1990-1993.

The Missisquoi Crop Management Association

The Crop Management Service Program was designed to be a pilot program that would eventually become self-sustaining so that it would continue beyond the funding period of the project. In an attempt to accomplish that goal, ICM services were offered free of charge in the first year to encourage participation without financial risk; but in successive years, farmers were required to pay an increasing share of the cost of the services (Table 2). The intent was to have a self-supporting program by the end of the 5-year funding period -- whether by private consultants, by a crop management association, or by farmers providing their own crop management services. That goal became a reality in the 1995 growing season with formation of the Missisquoi Crop Management Association (MCMA), a farmer-owned and operated crop management association.

The Association offers the same services as were offered by the Crop Management Service Program. However, the ability to pick and choose services has been greatly increased to allow members to pay only for services they feel they need. All costs for services are based on the "actual cost of doing business."

During the 1996 season the MCMA had 12 members and over 2,000 acres enrolled (800 acres of corn, primarily silage, and over 1,200 acres of legume and grass hay). A complete nutrient management program was done on 152 fields, including most of the crop acreage in the program. Scouting for a variety of pests was carried out on 55 corn fields (656 acres) and 14 alfalfa fields (170 acres). Corn scouting included fall and spring weed assessments, plant population counts, corn rootworm counts, and/or a complete weed management package. Alfalfa scouting options were fall and spring crown counts and scouting for potato leafhopper and alfalfa weevil. Computerized crop record keeping was carried out on ten farms (168 fields).

Cost (\$ per acre) of Crop Management Services by Crop

Year	Corn	Alfalfa	Clover	Grass
1991	0	0	0	0
1992	2	2	1	1
1993	4	4	2	2
1994				
Complete	6	6	3	3
Nutrient only	4	3	3	3

Summary:

Nineteen farms have participated in the Missisquoi Crop Management Services since 1991. The Missisquoi Crop Management Association, a farmer owned and managed independent organization, grew out of the Crop Management Service and now has twelve members and over 2,000 acres enrolled.

Soil test levels varied greatly among fields (low to excessive) and manure nutrient content showed two-fold differences among farms, emphasizing the importance of soil testing and manure analysis for field-specific nutrient management plans.

Farmers enrolled in the Crop Management Services program generally followed the nutrient recommendations made by the project technician. This resulted in nutrient applications that reduced loading of phosphorus to fields and decreased fertilizer costs to the farmers, contributing to both water quality and economic goals of the project.

Project Coordinators:

The Lower Missisquoi Water Quality Project is a cooperative effort among, the following participants:

- C Missisquoi Watershed Project Area Farmers
- C UVM Extension
- C USDA Farm Services Agency
- C USDA Natural Resource Conservation Service
- C Vermont Department of Agriculture, Food and Markets
- C Franklin County Natural Resource Conservation District

For More Information:

This factsheet is number four in a series on the Lower Missisquoi Water Quality Project. For information on obtaining other factsheets or for more information on the project, contact:

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