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An Evaluation of Nutrient Management Planning and Impacts: French Creek Watershed, Chautauqua County, New York

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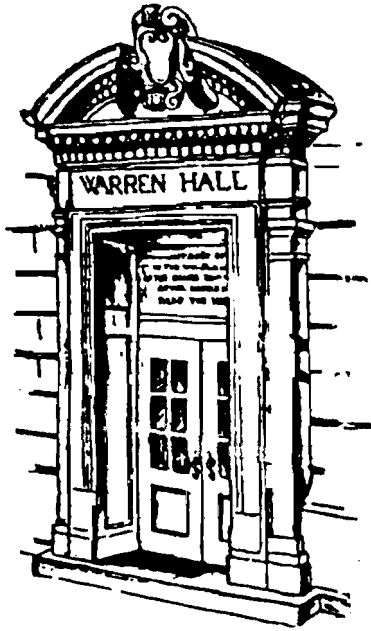
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Staff Paper

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AN EVALUATION OF NUTRIENT MANAGEMENT PLANNING AND IMPACTS:

**FRENCH CREEK WATERSHED,
CHAUTAUQUA COUNTY, NEW YORK**

**CARLOS SANTOS, WAYNE KNOBLAUCH,
& DAVID GROSS**

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PREFACE

The authors of this staff paper are Carlos A. Santos, Master's degree candidate, Dr. Wayne Knoblauch, Professor of the Department of Agricultural, Resource and Managerial Economics, and Dr. David Gross, Senior Extension Associate, Department of Natural Resources, Cornell University.

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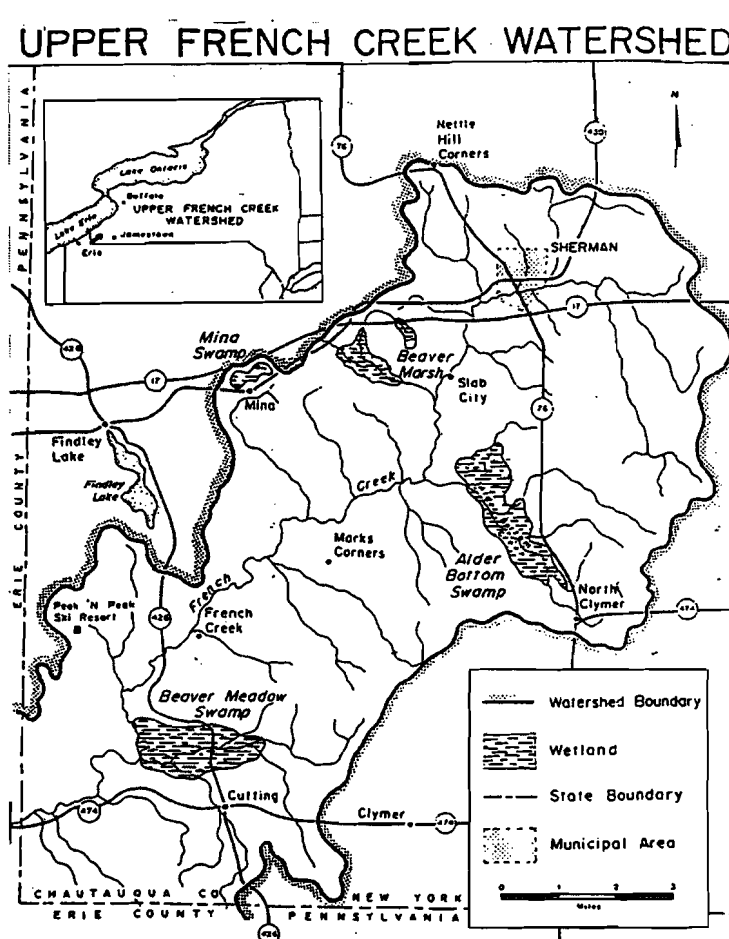
EVALUATION OF NUTRIENT MANAGEMENT PLANNING AND IMPACTS: FRENCH CREEK WATERSHED, CHAUTAUQUA COUNTY, NEW YORK

1. INTRODUCTION

French Creek has long been recognized as one of the most biologically diverse aquatic systems in the northeast, supporting 98 species of fish and mussels (Hansen, 1983). Land use in the portion of the French Creek Watershed that is in the State of New York is dominated by agriculture, primarily dairy farming (Figure 1). Seventy-two farms are estimated to be located in the French Creek Watershed, half of which are adjacent to stream corridors. In this type of activity, manure management is a primary concern in order to protect watershed. The key to handling manure in an environmentally sound manner is to follow practices that ensure manure will be applied at the proper time to minimize runoff, and at the proper rate to minimize leakage into ground water.

For several years, a coalition consisting of The Nature Conservancy (a non-profit conservation organization), Cornell Cooperative Extension of Chautauqua County, USDA Natural Resources Conservation Service (NRCS), and Chautauqua County Soil and Water Conservation District have worked with the agricultural community to decrease nutrient runoff and sedimentation through best management practices (BMPs), while helping farmers remain profitable.

Figure 1: Map of New York Portion of The French Creek Watershed



The French Creek Watershed Nutrient Management Program (FCWNMP) is one component of this larger collaborative effort to improve the water quality of the creek. The Program is ongoing and involves various funding sources including private support (The Nature Conservancy), the Environmental Protection Fund (NYS Agriculture and Markets) and the Environmental Quality Incentives Program (USDA NRCS). The cornerstone of the program is Nutrient Management Planning (NMP) which is a process that evaluates and selects BMPs to be included in a plan that meets both environmental goals of the watershed and business goals of the individual farmer.

The USDA Natural Resources Conservation Service (1999) defines nutrient management as programs designed to manage the amount, source, placement, form, and timing of the application of nutrients and soil amendments. The purposes of the NMP's are to budget and supply nutrients for plant production; to properly utilize manure or organic by-products as a plant nutrient source; to minimize agricultural non-point source pollution of surface and ground water resources; and to maintain or improve the physical, chemical and biological condition of the soil. A NMP is a documented record of how nutrients will be used for plant production. The plan is prepared for reference and use by the producer or landowner (NRCS, 1999).

Since 1995, cost-share assistance has been provided for seventeen farmers in the French Creek Watershed to develop and implement nutrient management plans. The Western New York Crop Management Association in Chautauqua County and Brookside Laboratories were contracted to develop and assist in implementing the NMP's on these farms. Each NMP included a list of fields and soil characteristics, an analysis of the manure and the estimate of the availability of nitrogen, a review of the desired cropping rotation, the subsequent nitrogen requirements, and the weight of manure needed to supply that nitrogen. From this information, a maximum loading rate of manure for each farm was calculated. Based on the number of head of livestock on the farm, an estimate of the amount of manure produced was made and compared to the maximum loading rate. Finally, recommendations for supplemented commercial fertilizer and pesticides were included in the plan.

The objective of this study is to obtain and evaluate farmers experiences with the FCWNMP, to identify the type and extent of the plans developed, the degree to which the NMP's were implemented by farmers, and the impacts on fertilizer application and farm profitability. In addition, the project identifies the reasons why farmers did not choose to continue participating in this planning process, as well as their awareness of environmental issues and relationship with organizations working in the area (Cornell Cooperative extension (CCE), NRCS, Soil and Water Conservation District (SWCD), The Nature Conservancy, etc.).

2. RESEARCH METHOD

The study involved the use of a survey administered by personal interview to farmers located in the French Creek Watershed (Chautauqua County, New York). The survey instrument (Appendix 1) focussed on gathering information on the farms, the NMP implemented, the outcomes and impacts of the implementation of the NMP, improvement suggestions for the FCWNMP, and the awareness of environmental issues. The list of 17 farmers to be interviewed was constructed from the list of farmers that have participated in the FCWNMP, and a farmer that was independently implementing a similar NMP was also included in the study.

After an iterative process of designing a survey format to address the research objectives, a consultation meeting was held with TNC, CCE, and the certified crop advisors. Following the meeting, the survey instrument was pre-tested. The objective of the pre-test was to assess the survey format and questions. One farmer was selected for the pretest. Following the pretest, the necessary changes were made to the survey.

In addition to the seventeen farms supported by the FCWNMP, one farm had a nutrient management plan prepared independently, but consistent with the program. Of the 18 farmers on the initial list (17 TNC cooperators and 1 independent), 14 (including the independent) agreed to participate in the interview after being contacted by letter (Appendix 2) and a follow up telephone call. After the interview, a thank you letter was sent to all the farmers that participated in the study (Appendix 3).

In order to evaluate the differences between the farmers that decided to continue with the NMP and the farmers that are not continuing with a formal NMP, descriptive statistics, cross-tabulations and the chi-square test statistic were used (SPSS Inc., 1993). A review of the cross-tabulations provides an indication of the characteristics that distinguish these two groups. Continuing with a NMP was defined as continuing with the same program of soil tests and nutrient management recommendations as with TNC program. Non-formal participation was defined as following the guidelines learned from participating in the program, but not conducting soil tests and reviewing the plan on an annual basis.

3. RESULTS

3.1. Sample Description

The farms that participated in the study had an average herd size of 137 cows and 309.3 acres of tillable land (Table 1). Most of the farms in the study had fewer than 120 cows. All the farms are concentrated in a small geographical area in the portion of the French Creek Watershed that is in New York. Half of the farms had a change in ownership/management in the last 10 years (mainly passed on to a new generation). The

majority (10) had not implemented a NMP in the past, before or in addition to the FCWNMP.

Table 1. Characteristics of the 14 farms that participated in the study

Characteristic	Minimum	Maximum	Mean	Std. Deviation
Number of cows	42	420	137.1	127.4
Animal units (in 1000 lbs.)	71.4	837	256.2	246.7
Total tillable land (acres)	85	950	309.3	235.0
Acres corn	0	410	118.4	121.0
Acres hay/grass	60	540	207.8	130.2
Ratio total acres/# cows	1.36	4.00	2.55	0.82
Ratio total acre/animal units	0.68	2.67	1.45	0.61

3.2. Nutrient management program implementation

Out of the 14 initial farmers in the sample, one did not recall participating in the FCWNMP, and therefore could not provide a complete response to the survey instrument. Consequently, for some analyses, the sample was only 13 farms.

The initial reason cited by farmers for participating in the program was that it was free. They also participated for pragmatic (to do things better, 92%), strategic (to gain advantages, 100%) and pedagogical (to learn, 85%) reasons. The majority of the farmers (54%) regarded the suggested NMP as being very similar to the agricultural practices being done before the FCWNMP, and 46% regarded the NMP as suggesting only some minor changes in their prior practices.

The NMP suggested to the farmers mainly consisted of soil and manure samples, as well as manure spreading and commercial fertilizer recommendations. Other components of the NMP, although in a lower degree, were crop rotation and pesticide recommendations. All the farmers closely followed the plan suggested. Small deviations from the plan occurred on some farms with respect to fertilizer application rates, herbicide selection and manure application. Spreading manure on distant fields in inclement weather or during exceptionally busy seasons was not always accomplished.

3.3. Nutrient management program outcomes

Only two farmers perceived that the NMP was going to be difficult to implement. However, after their participation in the program they thought that it was not difficult at all. None of the farms experienced crop nutrient problems since implementing their NMP. Crop nutrient problems were defined as a shortage of an important nutrient. Sixty

two percent of the farmers perceived that the NMP needed some adjustments, mainly in the fertilizer and pesticide recommendations to meet new challenges, such as new weed problems and the logistics of specific fertilizer analyses for small fields.

The herd size of most farms remained constant or increased after participating in the FCWNMP (Table 2). Increasing herd size, on 31 percent of the farms, was not caused by implementation of the NMP. The main impact of the NMP on fertilizer use was that it tended to reduce the amount of phosphorous and potassium supplemented with commercial fertilizers. The use of commercial nitrogen fertilizer increased on 31 percent of the farms due to operating below the recommended requirements, particularly in grasses, prior to the development of the NMP. Lime use was increased on 31 percent of the farms in order to gain the recommended level for efficient production. An important factor was that most farmers thought that their crop quality and yields increased with the use of NMP, none experienced a decrease in yields.

Although the majority of farmers continued to spread manure on the same fields, rates and distances as before, these farmers were the ones that were already covering the entire number of fields. However, the majority of the farmers became more aware of the importance of spreading the manure uniformly and to avoid seasonally wet areas. In addition, only two thirds of the farmers knew the spreading rate and uniformity of spread after the implementation of the NMP because of a lack of logistical support (scales), to weigh the manure (Table 3). However, the vast majority of the farmers did get to know the fields that are high in phosphorous and the ones that would respond to more manure (Table 4).

Table 2. Impacts of the NMP on the interviewed farms (percentage of 13 farms)

Change in	Decreased	Same	Increased
Herd size	8%	61%	31%
Nitrogen fertilizer	23%	46%	31%
Phosphorus fertilizer	46%	46%	8%
Potassium fertilizer	38%	54%	8%
Crop/grass quality	0%	46%	54%
Yield	0%	38%	62%
Lime use	8%	61%	31%

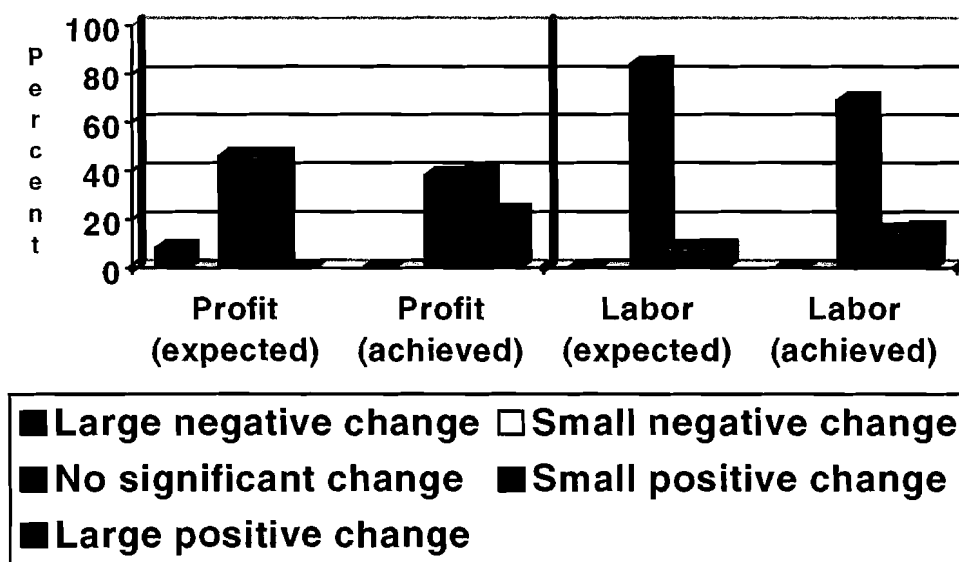
Table 3. Impacts on manure management (percentage of 13 farms)

Change in	Less	Same	More
Number of fields covered	0%	77%	23%
Spreading rate	15%	54%	31%
Distance spread	0%	77%	23%
Uniformity of spread	0%	46%	54%
Avoid wet areas	0%	46%	54%

Table 4. Impacts on knowledge of farmers (percentage of 13 farms)

Since implementing the NMP, you know your	No	Yes
Spreading rate	38%	62%
Uniformity of spread	31%	69%
Fields high in phosphorus	8%	92%
Fields that respond to added manure	8%	92%

Overall, farmers tended to actually achieve a greater improvement in profitability from the NMP than what they initially expected (Figure 2). Although some farms expected a negative change in profits, after implementing the NMP, the majority of the farms had a small to large positive change in their profitability. However, one farm had a larger labor requirement than expected, mainly due to a larger emphasis on spreading and incorporating manure in the spring, where many other activities are also needed in the farm.

Figure 2. Changes in profitability and labor requirements (percentage of 13 farms)

3.4. Differences between farms continuing or not in the FCWNMP

For this analysis, the farmers were divided into two groups: farmers that do not plan to continue with a formal NMP (six farmers) and farmers that do plan to continue with a formal NMP (eight farmers). Although not statistically significant, there seems to be a positive correlation with farm size (number of cows, animal units, and total tillable land) and the attitude to continue with a formal NMP (Table 5). That is larger farms were more likely to continue participation in the program. The main reason given by smaller farmers for their non-participation was that the small size of their farm does not justify the cost of contracting with a crop advisor to establish a NMP. Another reason given by farmers that own smaller farms was that since their acres per cow ratio was higher than

the recommended standard of two acres per cow, they really did not need a NMP. They believed they were not over applying the manure produced on any field. The negative correlation between total acres per cow or per animal unit and the tendency to continue with formal NMP's also corroborates this last result. Farmers with farms that have a lower acre per cow or per animal unit ratio were more aware of the need and importance of these NMP's to first, save them money, and second, to protect the environment.

Farmers that did perceive a need to implement NMP's are more inclined to continue with the FCWNMP (Table 6). Another important factor that may have influenced farmers to continue with the FCWNMP is their expected change in profitability because of implementing the NMP. Farmers that expected a small positive increase in the profitability of the farm do plan to continue with the NMP. However, these results were not corroborated by the actual change in profitability achieved by the farmers. Farmers that are considering continuing with the FCWNMP are also the ones that are already involved in riparian fencing and streambank buffers. This may indicate that the more environmentally aware farmers are the ones that plan to invest in NMP.

Table 5. Correlation: farms continuing/not continuing NMP and farm size

	Correlation ^a	Statistical signif. ^b
Number of cows	0.316	0.271
Animal units (x 1000 lbs.)	0.314	0.275
Total tillable land (acres)	0.214	0.463
Ratio (total acres/number of cows)	-0.446	0.110
Ratio (total acres/animal units)	-0.458	0.099
Perception of a need for NMP	0.501	0.081

^a The correlation coefficient is a measure of linear association between two variables, and lies between -1 and +1, -1 indicating perfect negative association and +1 indicating a perfect positive association. A correlation of zero indicates no association between the two variables (Gujarati, 1995).

^b Generally, a statistical significance of 0.10 or less is considered a result not provided by random error.

Table 6. Cross-tabulation tables (1-3): farms planning to continue or not with NMP

Plan to continue with FCWNMP		Perceived need for NMP?		Change in profit expected			Change in profit achieved		
		No	Yes	Large negative	No sig. change	Small positive	No sig. change	Small positive	Large positive
NO	Count	3	2	1	4		2	2	1
	Percent	60%	40%	20%	80%		40%	40%	20%
YES	Count	1	7		2	6	3	3	2
	Percent	12.5%	87.5%		25%	75%	37.5%	37.5%	25%
SIGNIFICANCE ¹		3.259; 1; 0.071		7.367; 2; 0.025			0.043; 2; 0.979		

¹ Pearson chi-square; degrees of freedom; statistical significance (a statistical significance of 0.10 or less indicates that the continuation in the FCWNMP depends on the perceived need of NMP and the change in profits expected) (Ott, 1993).

Table 7. Cross-tabulation tables (4-6): farms planning to continue or not with NMP

Plan to continue with FCWNMP		Have riparian fencing		Have streambank buffers	
		No	Yes	No	Yes
NO	Count	2	3	1	4
	Percent	40%	60%	20%	80%
YES	Count	7	1	6	2
	Percent	87.5%	12.5%	75%	25%
SIGNIFICANCE ¹		3.259; 1; 0.071		3.745; 1; 0.053	

¹ Pearson chi-square; degrees of freedom; statistical significance (a statistical significance of 0.10 or less indicates that the continuation in the FCWNMP depends on past implementation of BMP's: fencing and buffers) (Ott, 1993).

3.5. Awareness of environmental issues

All of the farmers perceived that the main advantage of implementing a NMP was to wisely use their soil nutrients, (Table 8). In particular they believe that NMP's are economical to do, that they permit a better management of their soil fertility, and that they help in protecting the environment. However, more emphasis was given to the economic reason. The majority of the farmers thought that NMP's do help protect the watershed and that their implementation does make a difference towards protecting their resources. The larger awareness of environmental issues was evident in the vast majority of the farmers, particularly of the benefits of not using excess fertilizer. Most of the farmers did not believe that their interest in environmental issues has increased over the years since they regard themselves as always being aware of these issues. An important consideration is that the majority of the farmers also thought that the adoption of NMP's is moving them towards compliance of future governmental regulations regarding the protection of the environment.

Table 8. Awareness of environmental issues (out of 13 farms)

Issue	# farms	%
NMP's protect the watershed	11	85
NMP make a difference	10	77
More aware of environmental issues	12	92
Agriculture has a large impact on the watershed	10	77
More aware of pollution problems	7	54
More aware of benefits of not using excess fertilizer	11	85
Increase in interest of environmental issues	5	39
Efforts are meeting future governmental regulations	11	85

All of the farmers thought that The Nature Conservancy's (TNC) main role was to increase awareness of environmental issues by farmers and the community in general, as well as to provide financial support and cost-share assistance (Table 9). An important consideration is the positive view regarding the approach taken by TNC in encouraging changes to farmers' agricultural practices. They particularly regarded as important the

fact that TNC does not impose but rather finds solutions through consideration of the farmers' point of view. The majority of the farms (10) also had a large involvement with other organizations in the area that are also working to protect the environment in a way that is also beneficial for the farming community.

Table 9. Role of The Nature Conservancy

Role	# farms	%
Increase awareness and education of farmers	6	46
Increase awareness, financial support and positive approach	3	23
Increase awareness and financial support	4	31

3.6. Suggestions for improvement of the NMP

All the farmers had a favorable overall impression of the FCWNMP. All but one of the farmers thought that the NMP helped them manage their nutrients better than before. The main aspect that they liked about the NMP was that they learned that they were doing things well. Other things that they liked were that they learned that they could budget their expenses more properly, and that the program had a positive approach. This last impression was related to the fact that they liked that the changes were being voluntarily done by the farmers through TNC's encouragement (positive approach). The only aspect that several farmers mentioned to not have liked was the lack of logistical support, mainly a scale to weigh the manure. Of the six farmers no longer participating in the project, five said that they would participate again if it were free. They conclude that the small size of their farm does not justify economically the cost of implementing the NMP and that they need financial assistance to implement them.

A large percentage of the farmers could not think of any suggestions for improvement, and several farmers considered that they personally needed to improve (not the program), particularly in keeping better records and dedicating more time to implement the NMP (Table 10). One suggestion that came up again was the issue that scales were not available to weigh the manure at the proper time. An important consideration of some farmers was that the program needs more follow-up including assistance on other BMPs. Farmers also indicated that they would like cost-share assistance to continue with NMP since they perceive that the beneficial results are more visible over the long run.

Table 10. Improvement suggestions for the NMP (out of 13 farms)

Improvement suggestion	# farms	%
Increase the logistics (scale availability)	2	15
Continuity of the program for more years	3	23
Personal improvement of the farmer (records and dedication)	3	23
All of the above reasons	1	8
No suggestions (good program)	4	31

In order to make the NMP easier to implement, farmers suggested the inclusion of other BMP's (such as manure storage systems or new spreaders); more attention to timeliness; more follow-through in the implementation of the NMP; and more cost-share assistance (Table 11). Factors not related to the NMP were the need of farmers to improve their own record keeping, better weather conditions, and more dedication on the part of the farmers.

Table 11. Improvements to make the NMP easier to implement (out of 13 farms)

Suggestion	# farms	%
Manure storage system or new spreader	2	15
Other factors not related to NMP (weather, farmer dedication)	2	15
Timeliness in the advice, continuance in the program	1	8
Better record-keeping	1	8
More financial and cost-share assistance	1	8
Nothing, all was good	6	46

An important factor that was considered a barrier towards implementing the NMP was the lack of time of the farmer, and consequently the lack of labor (table 12). This is particularly relevant in the spring, when many other seasonal tasks concentrate.

Table 12. Barriers for the implementation of the NMP (out of 13 farms)

Barrier	# farms	%
Lack of time	5	38
Lack of labor	3	23
Lack of capital	2	15
Lack of information	0	0
Lack of technical and cost-share assistance	3	23

The majority of the farmers plan to improve the nutrient management practices that are being implemented at the farm, both formally and informally (Table 13). The farmers that are not considering NMP in their future are either planning to sell the farm, or think that they do not need NMP's.

Table 13. Further NMP (out of 13 farms)

Next step	# farms	%
Improve their NMP implemented	10	77
Continue only with free soil samples provided by agribusiness's	1	8
Reduce the use of NMP (selling the farm)	1	8
No NMP at all	1	8

Table 14 indicates what the farmers learned from their participation in the NMP. The response includes an enhancement of the knowledge on their soil fertility and response to fertilization, the importance of manure management, awareness of environmental issues, and that they are doing things in compliance with protecting the environment.

Table 14. Learned from the NMP (out of 13 farms)

Learned	# farms	%
Nothing new	1	8
Soil fertility and response to fertilization	4	31
Importance of manure management	2	15
Environmental awareness and profit benefits	3	23
That they were doing things right	3	23

Table 15 provides a list of other BMPs that are practiced on the interviewed farms, or that are considered important to implement in the near future (next 5 years). These are not Stone stream crossings are not considered important, and farmers are particularly concerned with the effect of the stones on the cows' feet. However, they do tend to consider riparian fencing as important and plan to do so in the future. There has been a large amount of work done in the areas of barnyard runoff management and conservation tillage, mainly with collaboration with the Soil and Water Conservation District and NRCS.

Table 15. Best management practices in the interviewed farms

Best management practice	Have		Plan to	
	implemented		implement/improve	
	# farms	%	# Farms	%
Manure storage structure	6	46	7	54
Stone stream crossings	1	8	3	23
Barnyard runoff management	6	46	7	54
Conservation tillage	7	54	6	46
Composting facilities	0	0	0	0
Riparian fencing	4	31	6	46
Silage/haylage leachate management	5	39	8	62
Streambank buffers	6	46	3	23

4. SUMMARY

The objective of this study was to evaluate farmers' experiences with the FCWNMP, the type and extent of the NMP's developed, the degree to which the NMP's were implemented by the farmers, and the impacts on fertilizer application and farm profitability. In addition, the project identifies the reasons why farmers did not choose to continue with the FCWNMP. The study involved the use of a survey administered by personal interview to the farmers that participated in the FCWNMP. The statistical tools used include descriptive statistics, correlation and cross-tabulation analysis.

Of the 14 farmers that participated in the study, six are not continuing with a formal NMP (but are following the NMP guidelines learned through the FCWNMP), and eight are continuing with a formal NMP. The farmers interviewed had an average of 137 cows and 309.3 acres of tillable land. Out of the 14 initial farmers in the sample, one did not recall participating in the FCWNMP, and did not provide any responses to portions of the survey instrument. This left the sample with 13 farms for many of the questions.

The initial reason for participating in the program of all of the farmers involved in the program was that it was free. They participated in the NMP to gain advantages (reduce cost of fertilization), do things better (for the environment), and to learn (how to manage their nutrients). The majority of the farmers regarded the suggested NMP as being very similar to the agricultural practices being done prior to the implementation of the NMP. The NMP suggested to the farmers mainly consisted of soil and manure samples, as well as manure spreading and commercial fertilizer recommendations.

The main impact of the NMP was that it tended to reduce the amount of phosphorous and potassium supplemented with commercial fertilizers. An important factor was that most farmers thought that their crop quality and yields increased with the use of NMP. In addition the majority of the farmers became more aware of the importance of spreading the manure uniformly, as well as to avoid the seasonally wet areas.

Overall, farmers tended to actually achieve more positive results in profitability from the NMP than what they initially expected. Although some farms expected a negative change in profits, after implementing the NMP, the majority of the farms had a small to large positive change in their profitability. However, they also had a larger labor requirement than expected, mainly due to a larger emphasis on spreading manure in the spring, when many other activities are concentrated.

The main aspects that differentiate the farmers that plan to continue with the FCWNMP (eight farms) from the farmers that do not plan to do so (six farms) were larger farm size (although not statistically significant), lower acre per cow or per animal unit ratio, and more awareness of the need and importance of NMP's. These last two characteristics were related. The main reasons for not continuing with the FCWNMP

given by farmers that own smaller farms were that their small size does not justify the cost of contracting with a crop advisor to establish a NMP, and that they do not need a NMP. Farmers that are considering continuing with NMP's are also the ones that are already involved in riparian fencing and streambank buffers. This may indicate that the more environmentally aware farmers are the ones that plan to invest in a NMP.

Another important factor that may have influenced farmers continuing in the FCWNMP is their expected change in profitability because of implementing the NMP. Farmers that expected a positive increase in the profitability of the farm do plan to continue with the NMP. However, this result was not corroborated by the actual change in profitability achieved by the farmers.

Of the six farmers no longer participating in the FCWNMP, five said that they would participate again if it were free. They conclude that the small size of their farm does not justify the cost of implementing the NMP and that they need cost-share assistance. However, the majority of the farmers plan to improve the nutrient management practices that are being implemented at the farm, either formally or informally.

All of the farmers viewed favorably the use of a NMP. They perceived two advantages in particular: that it was economical to do and that it helps protect the environment. However, more emphasis was given to the economic reason. An important consideration is that the majority of the farmers also thought that the adoption of NMP's is moving them towards compliance of future governmental regulations regarding the protection of the environment. The main aspects that the farmers learned out of their participation in the NMP were the fertility of their soil, the importance of manure management, awareness of environmental issues, and that they are doing things in compliance with protecting the environment.

All the farmers thought that the role of TNC was to increase the awareness of environmental issues, as well as provide financial support and cost-share assistance. An important consideration is the positive view regarding the approach taken by TNC in encouraging changes to the farmers' agricultural practices. They particularly regarded as important the fact that TNC does not try to impose but rather find solutions thorough consideration of the farmers' point of view. The majority of the farmers also had a large involvement with the other organizations that are also working to protect the environment in a way that is also beneficial for the farming community.

Among the recommended suggestions proposed by the farmers to improve the FCWNMP were better record keeping and more dedication (on the farmers part), better logistical support (scales), more follow-up and integration of the NMP with other BMP's, and cost-share assistance. In order to make the NMP easier to implement the farmers suggested the implementation of other BMP's (manure storage) and more attention to timeliness in the provision of the NMP.

5. CONCLUSIONS

The main conclusions derived from this study are:

1. The Nutrient Management Planning (NMP) intervention was successful. Although eight farmers are continuing with the (French Creek Watershed Nutrient Management Program (FCWNMP), the farms that are not using the services of a CCA are still following the NMP guidelines learned through the program.
2. The NMP maintained or increased the profitability of the farms, although the labor requirements also increased, particularly during the spring.
3. Farmers require more assistance in aspects such as record keeping of manure spreading by field and planning assistance.
4. The Nature Conservancy (TNC) with the help of other collaborators had a positive impact on the farmers' awareness of the environmental issues of concern in the watershed, encouraging their stewardship efforts in a credible and respectful manner (positive approach).
5. The NMP was positively viewed by the farmers as a step towards meeting future governmental regulations.

APPENDIX 1. The survey instrument.

CORNELL French Creek Watershed Project Evaluation

U N I V E R S I T Y

The objective of this interview is to evaluate farmers experiences with the nutrient management planning process of the French Creek Watershed Project, the type and extent of plans developed, the degree to which the nutrient management plans were implemented by farmers, and the impacts on fertilizer application and farm profitability. In addition, the project will determine the reasons why farmers did not chose to participate in this planning process (or do not follow-up on the planning).

INTERVIEWER: _____

INTERVIEWEE (S): _____

Interview taped? Yes - No

Date: _____

Time: From _____ **to** _____

Part I: FARM DESCRIPTION

1. What type of operation best describes your farm?

Dairy – beef – horse – other livestock – cash crops – other _____

2. How many animal units (1 AU = 1,000 lbs. Animal weight) are on the farm? _____

Adult Cows _____ x _____ lbs./cow = _____ lbs.

Heifers (all ages) _____ x _____ lbs./heifer = _____ lbs.

Other livestock _____ x _____ lbs./animal = _____ lbs.

TOTAL = _____ lbs.

3. How many acres in production do you have? (including cropland, hayland, managed pastureland, and other on all owned and/or leased land) _____

Corn = _____ Acres Hay = _____ Acres

4. Has there been any changes in ownership / management of the farm in the last 10 years? (Since what year have you been in charge?)

5. Were other nutrient management plans done in the past, before or in addition to the French Creek Watershed Project? (explain)

Part II: NUTRIENT MANAGEMENT PROGRAM IMPLEMENTATION

1. What made you decide to participate in the nutrient management program?

2. Could you explain your involvement the nutrient management decision-making? (Was it explained and understood?) _____
3. Were the decisions that influenced this choice:
- 1 Pragmatic (to do it better) _____
 - 2 Strategic (to gain advantages) _____
 - 3 Inherent (an obvious next step) _____
 - 4 Pedagogical (to improve your knowledge) _____
 - 5 Other? _____
4. Could you describe the nutrient management plan suggested to you by the Crop Advisor (Dan Steward or Dave Maille)? _____
5. Could you describe the actual nutrient management plan implemented in the farm? _____
6. Why were these practices implemented? _____
7. What parts (if any) of the nutrient management plan were not implemented? _____
8. Why were these practices not implemented? _____
9. Was your implementation of the FCW nutrient management program intermittent / constant?
Why? _____
Did this change over time? _____
What circumstances influenced your decisions? _____

Part III: NUTRIENT MANAGEMENT PROGRAM OUTCOMES

1. What were your expectations on the difficulty of the plan proposed by Dan/Dave before implementing it? (and why) _____
2. What were your experiences on the difficulty of the plan proposed by Dan/Dave after its implementation? (and why) _____
3. Since implementing your nutrient management program (proposed by Dan/Dave):
- | | | | | |
|---|--|-----------|-----------|------|
| 1 | Animal numbers have | Increased | Decreased | Same |
| 2 | Nitrogen fertilizer use has (corn/hay) | Increased | Decreased | Same |
| 3 | Phosphorus fertilizer use has (corn/hay) | Increased | Decreased | Same |
| 4 | Potassium fertilizer use has (corn/hay) | Increased | Decreased | Same |
| 5 | Crop quality has (corn/hay) | Increased | Decreased | Same |
| 6 | Yield has (corn/hay) | Increased | Decreased | Same |
| 7 | Lime use has (corn/hay) | Increased | Decreased | Same |

4. Since implementing your nutrient management plan, do you spread manure:
- | | | |
|---------------------------------|---------------------------------|----------------|
| On more fields | On fewer fields | Same as before |
| At a different rate | No change | |
| Farther away | Closer | Same as before |
| More uniformly | Less uniformly | Same as before |
| Avoid seasonally wet areas more | Avoid seasonally wet areas less | Same as before |
5. What is the distance to the farthest field to which you take manure?
- Miles _____ Minutes _____
- Is this farther than before implementing the nutrient management plan?
- Increased Decreased Same
6. Since implementing the nutrient management program do you know,
- | | | |
|--|-----|----|
| Your manure spreading rate? | Yes | No |
| Your uniformity of spread? | Yes | No |
| Which fields are high in P? | Yes | No |
| Which fields will respond to added manure? | Yes | No |
7. Do you feel any adjustments are needed in the nutrient management plan that you are implementing? (yes / no) Why? _____
8. Have you had any crop nutrient problems since you participated in the NMP? (explain) _____
-
9. What impact on the profitability of your farm did you expect to result from the nutrient management program? (Why / how?)
- _____ A relatively large positive change
- _____ A relatively small positive change
- _____ No significant change
- _____ A relatively small negative change
- _____ A relatively large negative change
10. At this stage in the implementation of the plan, how has the nutrient management program affected the profitability of your farm? (Why / how?)
- _____ A relatively large positive change
- _____ A relatively small positive change
- _____ No significant change
- _____ A relatively small negative change
- _____ A relatively large negative change
11. What impact on the labor required for the operation of your farm did you expect to result from the implementation of the nutrient management program? (Why / how?)
- _____ A relatively large increase
- _____ A relatively small increase
- _____ No meaningful change
- _____ A relatively small decrease
- _____ A relatively large decrease

12. At this stage in the implementation of the plan, how has the nutrient management program affected the labor requirements of your farm? (Why / how?)
- _____ A relatively large increase
 - _____ A relatively small increase
 - _____ No meaningful change
 - _____ A relatively small decrease
 - _____ A relatively large decrease

Part IV: PROGRAM IMPROVEMENT SUGGESTIONS

1. What is your overall impression of the nutrient management planning process? (Favorable / Unfavorable) Why? _____
2. What did you like about the nutrient management plan? (Was your experience successful?) _____
3. What did you dislike about the nutrient management plan? _____
4. Do you think that the nutrient management plan helped you in managing your crop nutrients? If so, how? _____
If not, why? _____
5. How could the nutrient management planning process be improved? _____
6. How could the implementation process of the nutrient management plan be improved? _____
7. What would make the nutrient management plan easier to implement? _____
8. Do you plan to continue to be a part of the nutrient management program? (Why or why not) _____
9. What would make you reconsider this decision? _____
10. What were the major difficulties encountered when implementing the nutrient management plan?
 - 1 Lack of time _____
 - 2 Lack of labor _____
 - 3 Lack of capital _____
 - 4 Lack of information _____
 - 5 Need more technical or cost share assistance _____
 - 6 Other difficulties _____
11. Did these difficulties change over time and if so, why? _____

12. What is your farm's next step regarding the nutrient management program? (future)

13. What is your general approach for further nutrient management practices?

14. What did you learn or get out of your participation in the French Creek Water Quality Improvement Project?

15. Are you planning in the next 3-5 years to adopt or maintain any of the following practices?
In what areas would you most like help?

Best Management Practice	Have implemented	Plan to implement	Like help with implementing
Manure storage structure			
Stone stream crossing			
Barnyard plans (runoff management system)			
Conservation tillage			
Composting facilities			
Riparian fencing			
Silage leachate management			
Manure spreading management			
Commercial fertilizer management			
Soil testing and evaluation			
Streambank buffers			

Part V: PROGRAM AWARENESS

1. Do you believe there is an advantage in implementing a nutrient management program?
(Why?) _____

2. Do you feel the need to use nutrient management programs in order to protect the watershed?
Do you think its use makes a difference? _____

3. Are you aware of the biological significance and environmental issues of concern to the French Creek watershed project? (Explain)

4. What potential impacts do you believe agricultural practices have on the watershed?

5. Do you now more fully appreciate pollution problems after the development and implementation of the plan proposed by the Crop Advisor? (yes / no / unknown)

6. Are you more aware of the potential reduction in the effects of excessive nutrient application since implementing your nutrient management plan? (yes / no / unknown)

7. Did your interest in nutrient management programs evolve over time? (Explain) _____

8. What involvement have you had with agricultural organizations like NRCS, Soil and Water Conservation District, and Cornell Cooperative Extension?

How have you been helped by these organizations in the past? _____

9. What role is The Nature Conservancy playing in the French Creek watershed? _____

Have they provided you technical or financial assistance as you address agricultural and environmental issues? _____

10. Do you feel that this planning effort is meeting future compliance with governmental regulations?

OTHER NOTES:

THANK YOU VERY MUCH FOR YOUR HELP IN THIS STUDY.

APPENDIX 2. Initial letter sent to the farmers that participated in the FCWNMP

June 22, 1999

«Tit» «First_Name» «Last_Name»
«Address»
«City»

Dear «Tit» «Last_Name»,

Cornell University, in cooperation with The Nature Conservancy, Western New York Crop Management Association, Brookside Laboratories and Cooperative Extension Chautauqua County will be conducting a survey of nutrient management planning in the French Creek Watershed. We will be obtaining farmer participants opinions of the success of their nutrient management plans and ways the planning process could be improved. As a participant in the French Creek Watershed Project, we are asking for your cooperation in responding to questions that will enable an assessment of the impact of this program.

Within the next two weeks you will receive a call from Carlos Santos, a graduate student in Agricultural, Resource and Managerial Economics at Cornell University. He will be contacting you to answer any questions you may have on the general nature of the survey and to schedule a time when he can spend about one hour with you at your farm discussing your nutrient management plan. The plans we are considering are those prepared by either Dan Steward (Western New York Crop Management Association) or Dave Maille (Brookside Laboratories) as a part of the French Creek Watershed Project. We are not evaluating Dan or Dave, but rather determining what changes you made in your nutrient management program as a result of the plans and your assessment of their impact on your farm operation.

Your identity will not be disclosed when the results of the survey are shared with those interested in the French Creek Watershed and those working in other watersheds across the region. A copy of the results of the survey will be shared with you. If you have questions at any time, please call me.

Thank you for your cooperation.

Sincerely,

Wayne A. Knoblauch
Professor
(607) 255-1599

cc: Dan Steward
Dave Maille

APPENDIX 3. Thank you letter sent to the farmers that participated in the study

August 11, 1999

«Tit» «First_Name» «Last_Name»
«Address»
«City»,

Dear «Tit» «Last_Name»,

Thank you very much for being so generous with your time on «Interview_Date». I really appreciate your thoughtfulness and thoroughness in responding to the interview questions. All that I was able to learn from the visit will undoubtedly contribute significantly to the success of this effort.

I may need to solicit your help in clarifying some aspects of the interview in a near future. If you have any questions, please feel free to contact me at (607) 253-6419 or by Email at cas49@cornell.edu. Once again, thank you very much for your time and support of this study.

Sincerely,

Carlos A. Santos
MS Candidate
Cornell University

cc: Wayne Knoblauch, Ph.D., Cornell University
David Gross, Ph.D., Cornell University

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