Use of Whole Farm Analysis to Reduce Nutrient Losses, Improve Nutrient Cycling, Carbon Status and Energy Use on Small Dairies in New York State

Final Report for LNE08-271

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Region: Northeast
State: New York
Project Leader:

Patricia Ristow
Cornell University

Co-Leaders:

Dr. Quirine Ketterings
Cornell University

Project Information

Summary:

Four dairy farm management teams conducted three years of farm analyses and all teams saw a trend in improved nutrient use efficiency. Tools used for farm nutrient use assessment were Mass Nutrient Balance, Illinois Soil Nitrogen Test (ISNT), Soil Test Phosphorus (STP), Soil Test Potassium (STK), Corn Stalk Nitrate Tests (CSNT), manure analysis and farm maps. Teams met annually to discuss changes that were made on each farm and to review the analysis results and identify action items for the next year. A final evaluation allowed management teams to identify tools they will continue to use beyond the duration of this project for whole farm analysis and improving nutrient use. Useful tools identified were whole farm soil testing, farm maps and farm mass balance trends. Usefulness of whole farm soil testing was found to be linked to the presentation style of the results. Maps and graphs of soil testing results were used to make manure distribution decisions and prioritize manure applications. The soil test information most frequently used were the ISNT, STP and STK. Other nutrients and soil pH were presented in a summary table with interpretations which was found useful as a reference table. Corn stalk nitrates were found useful on the conventional dairy farms but were not found useful for the two organic dairy farms. Farm maps were rated as highly useful tools on all farms. Large, laminated farm maps that combined an aerial photograph of the farm with field boundaries, field ID and acreage were found to be an important tool for communicating nutrient testing and logistics to farm employees and off-farm consultants. In addition a book of maps that consisted of a front page showing the layout of the farm fields with field boundaries and road names followed by pages of close-up field maps showing field boundary, acreage and soil type were found useful

for more specific field management and particularly important for communicating with off-farm contract hires such pesticide and side-dress applicators. Farm nutrient mass balance trends were found useful strategic planning tools and while farms were glad that they were conducted and management teams used the information to interpret and understand soil testing data when interviewed, farm teams saw this tool being used less frequently in the future due to the difficulty in collecting the data to perform the analysis. Based on this feedback mass nutrient balance data collection required for the analysis were reduced and changes made to the MNB software for the 2011 season. The experiences from this project and the measured improvements in nutrient use efficiency were published in four articles featuring four different farms. Trainings were held for farm management and consulting professionals that allowed them to get hands-on training in using the different tools used in whole farm analysis. In addition the process that was used to integrate the results of farm analysis tools into farm decision-making will be compiled into a farm analysis practitioner's handbook to be published by the Nutrient Management Spear Program. The results from this project show that the tools implemented together with farm management meetings involving each farms local extension educator and the crop and nutrition consultants result in improved nutrient use efficiency.

- Farmer and Farm Advisor Quotes
- Bill Casey
- Howland Farm
- Mark Laribee
- Dave Vincent

Introduction:

Integrating Tools for Whole Farm Nutrient Use Optimization
Optimum nutrient use on a dairy farm can be defined as simultaneously achieving (1) long-term farm viability and (2) minimal nutrient loading to the environment. The goal of this project was to develop an assessment system that helps farm managers identify: (1) when the two objectives are met, (2) where opportunities are to further optimize, and (3) how management practices could be changed.

Working toward these objectives we have identified: (1) existing tools used for different farm nutrient use assessments; (2) a process by which the tools can be integrated into a whole farm nutrient evaluation and optimization process; (3) additional tools that are needed; (4) data needed for each assessment tool; (5) reporting formats that engage the most important component of any whole farm optimization system, the humans that manage them.

As tools have been identified they have been categorized in two ways (1) where the tools fit in a dairy farm system and (2) what part of the optimization process do the tools address? For this project optimization is defined as a continual cycle of monitoring, assessment, planning and implementation based on real-time farm data and measurements.

The dairy farm system
In this project we define the farming system as the Whole Farm made up of two sub-sectors (1) Dairy Production: Animal Management and Milk Production (2) Crop Production: Crop Production and Feed Management. The three sectors of the dairy farm have different timescales for production and therefore different appropriate timescales for assessment. The Whole Farm is most appropriately monitored annually while any inter-annual assessment is more appropriately done in the

individual farm sub sectors. The Animal Management and Milk Production subsector of the farm is a continuous production system and optimization requires frequent cycles through the optimization process in order to react to changing conditions. Animal Management could be monitored monthly or quarterly and Milk Production daily or weekly. Feed Management and Crop Production are production systems on longer time scales and more appropriately monitored weekly, monthly and/or annually for the feed management system and annually for the crop production system with multiple checks points during the growing season.

As part of this project we identified measurement tools and indicators of nutrient use and used them to continuously asses the whole farm, the dairy and crop production sectors of four case study dairy farms. After three years each farm management team provided feedback on how the tools fit into their management and advising programs.

Performance Target:

Four small dairy farms will, through the use of AEI-based whole farm analysis, implement management changes that resulted in improved nutrient use efficiency and farm energy use. Four county extension educators will become well-versed in the AEI-based data collection and whole farm analysis process with an additional eleven county educators being trained at bi-annual extension retreats. Seventy-five small farms will use the new AEI's through the voluntary NMB program. At least 35% (combination of NMB farmer meetings and popular press articles) of the small dairy farms in New York will become aware of the project and the benefits of whole-farm analyses and 15 additional farms will start implementing changes to improve nutrient use efficiency by the end of the project.

Cooperators

- Charles Benson

  Dairy Owner

  Bensvue Organic Dairy

  295 Lansingville Rd.
  Lansing, NY 14882

  (607) 342-3245 (office)

- Andra & Chuck Benson

  abenson2@twcny.rr.com

  Owner/Manager

  Bensvue Organic Dairy Farm

  295 Lansignville Rd
  Lansing , NY 14882

  (607) 342-2147 (office)

- Fay Benson

afb3@cornell.edu
Small Farms Educator
Cortland Cornell Cooperative Extension
60 Central Ave
Cortland, NY 13045
(607) 753-5213 (office)

- Larry Chase

lec7@cornell.edu
Professor
Department of Animal Science, Cornell Univ.
Morrison Hall, Room 272
Ithaca, NY 14853
(607) 255-2196 (office)

- Debbie Cherney

djc6@cornell.edu
Associate Professor
Department of Animal Science, Cornell Univ.
Morrison Hall, Room 324
Ithaca, NY 14853
(607) 255-2882 (office)

- Jerry Cherney

jhc5@cornell.edu
Professor
Department of Crop & Soil Sciences, Cornell Univ.
Bradfield Hall, Room 503
Ithaca, NY 14853
(607) 255-0945 (office)

- Peg Cook

pegcook@northnet.org
Crop Consultant
Cook's Consulting
RD#2 Box 13
Lowville, NY 13367

- Karl Czymmek

kjc12@cornell.edu

Senior Extension Associate
PRODAIRY, Cornell Univ.
Department of Animal Science
328 Morrison Hall
Ithaca, NY 14853
(607) 255-4890 (office)

- Janice Degni

jgd3@cornell.edu
Field Crops Educator,South-Central Region
Cornell Cooperative Extension
60 Central Ave
Cortland, NY 13045
(607) 753-5077 (office)

- Brian Gillette

bgillette@richer.com
Dairy Nutritionist & Feed Salesperson
Blue Seal Richer Feeds
(315) 778-5047 (office)

- Joanna Green

jg16@cornell.edu
Extension Associate
Cornell University Small Farms Program
135C Plant Science Bldg.
Cornell University
Ithaca, NY 14853
(607) 255-9227 (office)

- Marc Laribee

mclar@usadanet.net
Owner/Manager
Grace-way Farm
9560 State Route 26
Lowville, NY 13367
(315) 376-7038 (office)

- Joseph Lawrence

jrl65@cornell.edu

Field Crops Educator, Lewis County

Cornell Cooperative Extension

PO Box 72
5274 Outer Stowe Street
Lowville, NY 13367

(315) 376-5270 (office)

- Charles (Chuck) Nicholson

  cfn1@cornell.edu

  Senior Research Associate

  Cornell Program on Dairy Markets and Policy

  Department of Applied Economics and Management
  Warren Hall, Room 316
  Ithaca, NY 14853

  (607) 254-4901 (office)

- Caroline Rasmussen

  cnr2@cornell.edu

  Research Associate

  Nutrient Management Spear Team-Cornell University

  330 Morrison Hall
  Ithaca, NY 14853

- Patty Ristow

  plr27@cornell.edu

  Extension Associate

  Nutrient Management Spear Program, Cornell Univ.

  Department of Animal Science
  330 Morrison Hall
  Ithaca, NY 14853

  (607) 255-1723 (office)

- Dave Vincent

  DairyOwner

  Vincent Dair

  86 Vincent Rd.
  Malone, NY 12953

  (518) 572-9714 (office)

- Mike van Amburgh

  mev1@cornell.edu

Associate Professor
Department of Animal Science, Cornell Univ.
Morrison Hall, Room 272
Ithaca, NY 14853
(607) 254-4910 (office)

Research

Materials and methods:

Each dairy producer in this project assembled their team of advisors in year one of the project. The team met once per year to review the results of the different farm analysis components, identify opportunities and discuss actions steps for the following year.

The Nutrient Mass Balances (NMB) for nitrogen (N), phosphorus (P) and potassium (K) were used as a measure of whole farm nutrient balance and provided a common ground for discussions with both crop and dairy consultants. Nutrient Mass Balance assessments required data on annually imported nutrients (feeds, fertilizers, animals, bedding and manure) and annually exported nutrients (milk, crops, manure and animals). The NMB results were presented back to the farm in three variations: (1) farm trends in pounds of nutrients remaining per hundred weight of milk produced, (2) farm trends in pounds of nutrients remaining per tillable acre, (3) industry comparison.

Precision Feeding Benchmarks were identified as tools that could be used to track and assess dairy production performance. These tools were not actually implemented however since each farm management team identified a desire to focus on crop production measures.

Crop production measures used in this project included soil test results for macro and micro nutrients, Illinois Soil Nitrogen Test results, loss-on-ignition organic matter, corn stalk nitrate tests, manure analysis.

Research results and discussion:

NESARE Milestones #1
A research team will be formed for each participating farm made up of the farmer, county extension educator, and Cornell campus staff. This team will complete a baseline, year one and year two whole-farm analysis to identify nutrient use efficiency for N, P and K carbon status and energy use. The annual results will be used to identify and implement changes to improve nutrient, carbon and energy use efficiency during the second and third year. Efficiency gains will be quantified at the end of three years. (3 years)

Each dairy producer in this project assembled their team of advisors and the Nutrient Mass Balance (NMB) analysis provided a measure of nutrient use on the whole farm for the farm team to review and discuss. The result of the first meeting was an action plan for each farm team and an outline of expectations. After data collection and analysis got underway one to two meetings were held annually to discuss the results. To help focus team discussions each farm manager also identified a nutrient concern that they had on their farm at the initial meeting. The nutrient concerns identified on the farms were (1) What are my soil test trends given that my farm density has been increasing? (2) Are the herd health issues that

existed on the farm related to nutrient content of pastures, soils and/or forage? (3) Is the ash that I am bringing on to the farm helping my soil nutrient levels? (4) What do the nutrient levels look like on the farm since transitioning to organic production? The nutrient mass balance assessment was referred to at the beginning of each annual meeting to begin the discussions and the original nutrient concern was revisited to help focus larger-picture discussions and to identify if the information was providing guidance regarding specific nutrient concerns as well as guidance for whole farm strategic planning.

Farmer interviews at the end of the project illustrated that meeting as a team was an important aspect to turning the analysis results into action. Project participants were asked: “Four team meetings were held with the farm team and farm advisors. How valuable were the team meetings? How did they impact nutrient management decision making on the farm?” Six out of seven survey respondents rated the farm meetings a 1 or 2 out of 5 with 1 being the most useful. One respondent rated the farm meetings as not useful (5) because he felt the same conclusions had been drawn during the data collection and verification process during the year.

Nutrient Mass Balance

The Nutrient Mass Balances for nitrogen (N), phosphorus (P) and potassium (K) were used as a measure of whole farm nutrient balance and provided a common ground for discussions with both crop and dairy consultants. The NMB is a gauge for the balance between a livestock production system and associated land base that minimizes nutrient loss, optimizes production and increases nutrient recycling. The NMB is calculated as the difference between all imports and all exports

Farm teams were able to compare farm nutrient use performance to previous years on their own farm and to similar farms in the dairy industry. The NMB indicators illustrated that farms decreased the amount of nutrients remaining on the farm during the course of the project. While there was not a direct link between the NMB and day to day decisions that were made on the farm, the NMB worked as a catalyst for winter-time strategic planning discussions with farm management teams resulting in increased nutrient use efficiency. The NMB was found to actively engage farm management teams in identifying where the farm was and where they would like it to be and to ask the next big questions: “where and how to make changes on the farm”. Upon reviewing the Nutrient Mass Balance results the farm management team would immediately begin to hone in on specific parts of the farm that they wanted more information on to understand the situation better and to identify management changes for the following year.

Data collected during an annual NMB analysis was used to identify where opportunities may be on the farm. First by looking at (1) general farm imports and exports and then (2) specific items imported and exported. This information is used to Identify management practices that could be Investigated further.

In three years all the farms that participated in this project showed increased nutrient use efficiency by increasing the amount of purchased nutrient they were able to turn into a product leaving the farm. Increased efficiencies reduced the amount of N, P and K remaining on the farm as shown during the NMB analysis. On average the farms reduced N by 24 lbs N/acre with a range of 38 - 13 lbs N/acre reduction. Phosphorus was reduced by an average 6 lbs P/acre with a range from 11 - 2 lbs P/acre reduction. Potassium was reduced an average 18 lbs K/acre with a range from 47 - 6 lbs K/acre.

In terms of the whole farm optimization process the Mass Nutrient Balance answered the first question, “if the two objectives are being achieved”. The Mass Nutrient Balance tools have also allowed preliminary investigations toward answering the second question “where are opportunities to further optimize”. Tools

that help with specific details for Identifying, Planning, and Implementing management changes in the dairy and crop production sectors of the farm were the focus of inter-annual testing and assessment.

NESARE Milestones #2
1)The team will assess the farm data for potential internal (herd and cropping) system efficiency indicators and a list of data gaps will be generated. This information will be used to develop and implement record keeping systems (farm specific) to address data gaps. A protocol will be developed to calculate and interpret each of the herd and cropping efficiency indicators that are feasible with data found or generated easily on the four small farms and this will become part of the annual assessments.

The Dairy Production subsector of the farm is a continuous production system and optimization requires frequent cycles through the optimization process in order to react to changing conditions. One tool that was found to help monitor and evaluate these systems in a time-frame that is appropriate but also did not overwhelm daily functioning of dairy teams was the Precision Feed Management (PFM) benchmarking tool.

A Precision Feed Management (PFM) benchmark tool is one tool that had been developed to evaluate and monitor the diets and herd performance for different dairy groups on farms and is finding success in many of NYS's county dairy extension programs. The actual process of PFM implementation is not complicated, but revolves around a cycle of monitoring, assessment, planning and implementation. Monitoring involves on farm records as well as feed and herd production testing. Periodic meetings of key farm advisors can accomplish effective assessment and planning of tactics for implementation. Achieving the day to day and periodic benchmarks detailed below on a continual basis will result in minimized manure N and P excretions, optimal nutrient mass balances as well as increased income over purchased feed costs. Farms in this study did not identify dairy production and feeding as an area that they wanted to focus on during winter strategic meetings and therefore the PFM tools was not used to assess any of the farms.

Crop Production systems are on a longer time scales than Dairy Production. Crop production is more appropriately assessed and monitored annually on a field by field basis. The field performance measures identified for repeatability and tracking over time were; the Corn Stalk Nitrate Test (CSNT) and soil tests: Illinois Soil Nitrogen Test (ISNT), soil test phosphorus (STP) or soil test potassium (STK). These four measures were the focus of the nutrient use efficiency evaluations for crop production. Each indicator was collected for each field and then summarized by crop and whole farm.

Soil test data were used as individual field assessments and whole farm evaluations. Annual soil test summaries illustrate effectiveness of crop management rotation and manure management strategies in maintaining optimum soil test levels across the farm (spatially) and over time (temporally). One type of report that was developed during this project is a graphical representation of field soil test levels combined with a table summarizing the percent of farm acres falling into different soil test categories. We found that the presentation of soil test information on a field by field basis using farm-provided field names in a graph and a summary table provided a platform by which farmers could communicate their extensive history and knowledge about each individual field and how it got to have the soil test level that was measured and how they thought they could move forward. The graphs would stimulate a question about a particular field which would lead to the using the table to look up more soil test information on an individual field basis.

Field soil test levels have been identified as field performance measures for many years however fields are soil tested every three years and often at different stages of their crop rotations and the participants in this study found soil data in this format difficult to discuss and interpret. Two of the four casestudy farms (both organic farms) suggested that soil testing would be more useful if the whole farm was done every 2 to 5 years and the data presented as a whole farm assessment.

Corn stalk nitrate tests were new to all the case study farms. Only two of the four case study farms grew corn so only two of the farm evaluated the CSNT. On these two farms the results of the CSNT were combined with N management information for each field such as manure application rates, year in rotation, fertilizer N applications. Participants in the study responded that they liked the immediate and visual feedback this type of data synthesis gave them on how well nitrogen had been supplied to each field. They also expressed that the CSNT gave them confidence to continue to manage corn at close nitrogen fertility margins because they could measure when N management was providing too much, too little or just the right amount. In the second year of the study it was realized that testing the whole farm would not be feasible and a method for selecting a sub-set of fields was necessary. Participants chose a subset of fields to conduct a CSNT test on by reviewing nitrogen delivery records, year in crop and which fields were most likely to test high. They picked a subset of fields that they felt would span the spectrum of N delivery on their farm, from low to high. The subset of fields selected in this manner still provided farm managers and advisors with useful information that they used as they planned for next year’s manure allocation and fertilizer purchases.

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NESARE Milestones #3

2) Four extension educators will gain skills and experience throughout this process in data collection and whole farm analysis. They will collaborate with university staff to provide training for fellow extension educators at bi-annual field crop extension retreats (1-2 day events). A total of 15 dairy and field crop extension educators will be educated on the implementation and interpretation of whole farm analysis through these professional retreats (2 years).

Four Cornell cooperative extension educators and six consultants representing private industry (four crop consultants and two dairy nutrition consultants) were actively involved in this project and used the tools to help farm managers identify opportunities on their farm. A course was delivered in March 2011 that taught three components of the whole farm analysis program: Mass Nutrient Balances as a strategic planning tool, Fine-tuning N Management with the ISNT and CSNT, and Improving manure distribution by understanding the fertilizer replacement value of your manure. These components were taught in a session of Advanced Nutrient Management at the 2011 NYS Water Quality Symposium. The hands-on workshop was attended by twenty-two (22) Conservation District Employees, NRCS, private consultants and cooperative extension personnel.

NESARE Milestones #4

3) The most relevant AEI indicators will be included in the NMB project annual mass balance assessments in which 75 small farms participate. Of these 75 farms it is expected that at least 15 farmers will implement management changes, the results of which will be tracked through annual assessments that are part of the NMB Program.

The AEIs were incorporated into the NMB software and the larger database now includes 54 farms have used the tool for four years to monitor and make changes to their management practices. These farms illustrate the nutrient reduction potential for farms that measure and actively manage their nutrient mass balance for

multiple years. Farms reduced their NMB's 29-53% and the percent reduction was relative to the size of on their initial NMB.

In addition project impact interviews of the four casestudy farm management teams indicated that while each farm found the MNB analysis useful during winter strategic planning meetings they felt that the time needed to compile the information was too much for them to conduct the assessment annually. Based on this feedback, data requirements for the MNB analysis were rearranged to generate a two-tiered reporting format in which the first tier results in mass balance only (lbs/acre and lbs/cwt) while in the second tier, additional AEIs are reported. The new data collection sheet will be used in the 2011 MNB analysis (completed in the winter of 2011-2012 and reviewed prior to crop season 2012).

NESARE Milestones #5
4.) Four farm/project impact reports will be published in popular press journals such as Northeast Dairy Business, Small Farms Quarterly, Country Folks, and Farming magazines (1 year, over years 2 and 3). It is expected that these articles will be read by at least 35% of the small dairy farmers in New York State. In addition the results of this research will be published in a scientific peer-reviewed publication.

Four articles were published in the Small Farm's Quarterly which distributes approximately 27,000 copies across New England, New York, and Northern Pennsylvania. Each article featured a small dairy and how their participation in the whole farm analysis project and use of the tools presented to them during this project impacted management on their farms (see links listed below). Each article is also on the Nutrient Management Spear website (http://nmsp.cals.cornell.edu/guidelines/impact.html).

Zglobicki, Sara. 2009. Mass Nutrient Balance Project for Small Dairies. Small Farm's Quarterly. Spring 2009: page 8.
http://www.smallfarms.cornell.edu/pages/quarterly/archive/spring09/8REAL.pdf
Zglobicki, Sara. 2009. Balancing Act. Small Farm's Quarterly. Summer 2009: page 21.
http://www.smallfarms.cornell.edu/pages/quarterly/archive/summer09/21.pdf

Fields, Lisa. 2011. Whole Farm Nutrient Analysis: The Casey Farm. Small Farm's Quarterly. Fall 2011: page 4.
http://www.smallfarms.cornell.edu/pages/quarterly/archive/fall%202011/C4.pdf

Fields, Lisa. 2011. Howland Dairy Benefits from Whole Farm Analysis. Small Farm's Quarterly. Winter 2012: in press.
http://www.smallfarms.cornell.edu/quarterly/

Participation Summary

Education

Educational approach:

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Zglobicki, Sara. 2009. Mass Nutrient Balance Project for Small Dairies. Small Farm's

Quarterly. Spring 2009: page 8.http://www.smallfarms.cornell.edu/quarterly/

Zglobicki, Sara. 2009. Balancing Act. Small Farm's Quarterly. Summer 2009: page 21.http://www.smallfarms.cornell.edu/quarterly/

Fields, Lisa. 2011. Whole Farm Nutrient Analysis: The Casey Farm. Small Farm's Quarterly. Fall 2011: page 4. http://www.smallfarms.cornell.edu/quarterly/

Fields, Lisa. 2011. Howland Dairy Benefits from Whole Farm Analysis. Small Farm's Quarterly. Winter 2012: in press. http://www.smallfarms.cornell.edu/quarterly/

No milestones

Additional Project Outcomes

Project outcomes:

Impacts of Results/Outcomes

In three years all the farms that participated in this project showed increased nutrient use efficiency by increasing the amount of purchased nutrient they were able to turn into a product leaving the farm. Increased efficiencies reduced the amount of N, P and K remaining on the farm as shown during the NMB analysis. On average the farms reduced N by 24 lbs N/acre with a range of 38 - 13 lbs N/acre reduction. Phosphorus was reduced by an average 6 lbs P/acre with a range from 11 - 2 lbs P/acre reduction. Potassium was reduced an average 18 lbs K/acre with a range from 47 - 6 lbs K/acre. The hands-on workshop were attended by twenty-two (22) Conservation District Employees, NRCS, private consultants and cooperative extension personnel. Articles about the project were published in the Small Farm's Quarterly which distributes approximately 27,000 copies across New England, New York, and Northern Pennsylvania. Each article featured a small dairy and how their participation in the whole farm analysis project and use of the tools presented to them during this project impacted management on their farms. The AEIs were incorporated into the NMB software and the larger database now includes 54 farms have used the tool for four years to monitor and make changes to their management practices. These farms illustrate the nutrient reduction potential for farms that measure and actively manage their nutrient mass balance for multiple years. Farms reduced their NMB's 29-53% and the percent reduction was relative to the size of on their initial NMB.

Economic Analysis

An end-of-project assessment interview was conducted to understand the impacts that farm managers felt the project had on the farm. One question asked of them was, "Do you think participation in this project increased farm profitability?" Three out of four farmers responded:

Manager/Owner: "Not necessarily because we didn't have any major issues."

Manager/Owner: "Yes! It will help me increase forage quality, palatability and yields"

Manager/Owner: "While this project will not increase our farm profitability in the current year it will in the future. We will get better yields because our management changes are allowing better utilizes our manure."

Although it is unknown what the economic trends were for the 54 farms that participated in the NMB assessments for 4 years or more, the enhanced efficiencies (reduced balances) are expected to have had economic benefits as the case study farms showed no reduction in milk production while enhancing their nutrient use efficiency.

Farmer Adoption

Farmers and crop consultants were interviewed at the end of the project. The value of the strategic planning meetings as well as communication and strategic tools such as farm maps, soil test results displayed in such a way that whole farm trends could be seen and corn stalk nitrate tests were found to be the most valuable and most likely to be continued beyond the duration of the project. Farm managers were asked how the value of the project results compared to the time it took to be involved. Their responses were:

Manager/Owner: “This project was time consuming, and it was worth my time. The value was confirming that my management is working regarding nutrient status of the whole farm and crop system. I see the benefit of looking at this data in a team meeting in the winter.
Another reason I participated was to contribute to the research effort, contribution to the greater good counts as important to me.”

Manager/Owner: “This project was well worthwhile”

Manager/Owner: “This project was not time consuming and it was well worth our time. I would definitely recommend it to other farms.”

Farmer adoption was furthermore evident in the larger number of farms that submitted samples for CSNT and ISNT analyses and continued participation in the NMB assessment.

Assessment of Project Approach and Areas of Further Study:

Areas needing additional study

During the first year of this project each farm identified field yield (actual crop yield or milk yield per acre) to be the performance indicator by which they would like to objectively evaluate field management practices. Field by field yield records were not kept on any of the case study farms and represent a major data gap for field performance indicator development. In addition, our experience through this project showed a farm record-keeping framework that could assists farm managers and advisors in identifying and compiling data for crop strategic planning does not exist. We found that even in instances where farm records were kept, components were missing and data were stored in ways that did not allow synthesis into summaries (graphs and tables). A fair amount of time was needed to gather data so that each farm had a set of complete and usable records that included:

•Common field names in each data set on the farm: field maps, crops records, manure records, and soil tests records.
•Accurate maps – whole farm and field specific
•Updated soil tests.
•Manure analysis that were trusted by farm management.
•Manure records summarized from a day to day, load basis to a field by field rate basis.
•Combination of manure analysis with manure records to determine nutrient delivery.

Based on feedback from the case study farms, data requirements for the NMB analysis were rearranged to generate a two-tiered reporting format in which the first tier results in mass balance only (lbs/acre and lbs/cwt) while in the second tier, additional AEIs are reported. The new data collection sheet will be implemented for assessments of the 2011 NMB analysis (to be completed in 2012).

In addition, it became clear that a practitioners handbook will need to be developed that combines the experiences of this project and sister-projects, the views of the farmer and consultant participants on the use of the tools and suggestions for using the tools for achieving the level of impact that our research team has had during development of the tools and implementation process.

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