Nutrient Management Education: Perceptions and Influences

by

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Abstract

Soil testing, analysis, and implementation of associated recommendations are indicated as a key to development of nutrient management plans for Wisconsin farmers. Indeed a soil test is the only practical way to know the nutrient requirements of a soil to grow a desired crop. In Wisconsin, the University of Wisconsin Soils and Plant Analysis Lab, University of Wisconsin-Extension, Wisconsin Department of Agriculture, Trade and Consumer Protection, and Wisconsin Department of Natural Resources have a technical, regulatory, or educational role in ensuring farmers understand and appropriately utilize nutrient management plans for sustainable agricultural systems.

In the mid 1980's USDA and the State of Wisconsin began to tie nutrient management to agricultural program benefits and jurisdictional water quality regulations. In turn, UW-Extension Agriculture Educators began teaching, designing research, and evaluating nutrient management to measure outcomes in relation to environmental impact in addition to agronomic impact.

The purpose of this research was to examine nutrient management educational efforts by UW-Extension educators in Wisconsin. An electronic survey was used to explore how UW-Extension educators regard the practice of soil testing, analysis, and recommendations in their nutrient management educational programs and their perceptions of how the farmers interpret the need and value of nutrient management education.

Results of the survey indicate perceptions of educators are sometimes consistent with how valuable they consider the components of a nutrient management. It is suspected by the educators that though farmers believe following nutrient management recommendations is of agronomic value, they also believe farmers would not apply these principles if regulations and incentives were not in place. A common view appears to exist among UW- Extension

Agriculture educators that the education and outreach provided is useful and that farmers place value on nutrient management plans mostly for agronomic purposes vs. water quality. Though the survey was inconclusive in relating demographics and land characteristics to value and implementation of nutrient management, the results can inform how UW- Extension educators and specialists enhance educational programing for nutrient management education of Wisconsin Farmers.

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Chapter One: Introduction

Soil testing, analysis, and implementation of associated recommendations are indicated as a key management tool for Wisconsin farmers. Indeed a soil test is the only practical way to know the nutrient and lime requirements of a soil to grow a desired crop (Laboski & Peters, 2012). In Wisconsin, the University of Wisconsin Soils and Plant Analysis Lab, University of Wisconsin-Extension, Wisconsin Department of Agriculture, Trade and Consumer Protection, and Wisconsin Department of Natural Resources have a technical, regulatory, or educational role in ensuring farmers understand and appropriately utilize soil testing and analysis to manage for sustainable agricultural systems.

In the mid 1980's USDA and the State of Wisconsin began to tie nutrient management to agricultural program benefits and jurisdictional water quality regulations. Educators, including UW-Extension Agriculture Educators, began teaching, designing research, and evaluating nutrient management to measure outcomes in relation to environmental impact. No longer were yields and economic value the sole case for soil testing analysis and implementation of soil fertility best management practices.

In 2014, Wisconsin Department of Agriculture, Trade, and Consumer Protection reported 2.58 million acres of nutrient management plans completed, up from 0.7 million in 2004. This represents 24 % of the cropland acres in Wisconsin. Of these acres, only 42,000 (0.46%) were completed unrelated to cost-share program or regulatory requirements ("Wisconsin Nutrient Management Update", 2014).

Purpose

What influences the status of nutrient management education and outreach provided by UW- Extension agriculture educators and agents (hence forth “educators”) to Wisconsin farmers? Has the impact of regulatory and cost share accessibility altered the premise of agronomic sustainability that takes into account social, environmental, and economic viability?

This project examines the current nutrient management educational efforts by UW-Extension educators in Wisconsin. It explores how UW-Extension educators regard the practice of soil testing, analysis, and recommendations in their nutrient management educational programs and their perceptions of how the farmers interpret the need and value of nutrient management education. Moreover, it will attempt to draw a link between farmer demographics, target audience of education, and farmer incentives influencing the educational program. In understanding these qualities, University of Wisconsin-Extension educators and specialists can best enhance the educational and outreach programing for the nutrient management education of Wisconsin Farmers.

Chapter Two: Literature Review

The interaction between soil fertility and crop production has been researched and evaluated for well over a century by our Land Grant Institutions. The Morrow Plots of the University of Illinois are the oldest continuous agricultural research fields in the United Sates with soil fertility research beginning in 1876 ("The Morrow Plots: A Landmark for Agriculture" 2001).

Farmers in South Carolina began abandoning their farms when acidification of soils became a problem in the early 1900s. Research at Clemson College yielded a soil testing program to link improved crop yields with lime application. This was the birth of public soil testing in the south, recognized by farmers as a tool to sustainability (Moore, 2011).

The University of Wisconsin's Soils and Plant Analysis Laboratory has been addressing the chemical nature of soil since its establishment in 1913. Soil testing to characterize soil fertility status and ability to produce a specific crop was expanded to the Marshfield Experimental Farm in 1959 to address the needs of farmers and researchers in the north central region of the state (History of the Laboratories, 2011).

The University of Wisconsin-Extension has relied on soil testing as a cornerstone of its diagnostic testing protocol. The goals of Wisconsin's soil testing program are to:

1. Provide an accurate level of available nutrients in the soil.
2. Indicate the degree of nutrient deficiency that may exist for the various crops grown.
3. Suggest how the deficiency might be corrected.
4. Provide the results in an understandable and meaningful way so that the grower can make the appropriate decision as to what nutrients to add. (Laboski & Peters, 2012, pg.1).

In addition, the Soil and Plant Analysis Lab functions to provide data for support and extension of research by local agricultural educators and state specialists. The state lab also attends to quality

assurance for state certified soil labs outside the UW-System. By the mid 1940's soil testing was available to convince and support farmers in the use of commercially available fertilizers. As fertilizer application was realized as an acceptable practice to increase crop yield, fertilizers became an input worth managing efficiently by both university agronomists and farmers. At this time university labs were the main resource for soil testing and associated research. This research began to focus on correlation and calibration to address regional differences and was conducted at the university labs.

It was not until the 1960's when fertilizers prices were low and agronomic strides had made it possible to produce large yields that private labs became competitive in the soil testing market. At the same time, research for soil testing at the university level was scaled back as cheap fertilizers and the ability to achieve large yields decreased the perceived need to manage fertilizer efficiency ("Soils Home Study Course", 1999). During this time, university research was geared to confirming the efficacy of soil testing as a means of predicting nutrient needs to achieve yield goals. Beyond that, universities introduced the concept of sufficiency of soil nutrient levels to counter balance the trend of maintenance levels employed by the commercial labs. It was concluded that the maintenance concept of fertilizer recommendations was not essential and likely lead to over application of fertilizers. The sufficiency method of soil testing was considered adequate in addressing agronomic and environmental integrity (Olson, Frank, Grabouski, & Rehm, 1982). "Build-up" of soil nutrients was not necessary.

As environmental concerns and economic sustainability came to the forefront of agriculture in the 1970's soil testing entered a new era of increased research, education, and outreach by university agricultural campuses. Review of barriers to adopting sustainable agronomic practices indicate economic constraints, lack of concern, and comfort with traditional farming techniques are

responsible for slowing change (Drost, Long, Wilson, Miller, & Campbell, 1996). Drost et al. went on to explain that use of information by farmers is correlated to a developed working relationship with the educator. In their study of Utah farmers described as working towards a sustainable agronomic system, 42% indicated they did not use soil testing, the very practice considered by agronomists to be a key for a sustainable agriculture system. There was reason to believe that call to apply less fertilizers and manure to address environmental concerns was a risk to yields. Declining fertilizers rate recommendations by the university were often considered too conservative.

Since the mid 1980's in Wisconsin, much of the research and education around soil testing was to encourage soil testing and analysis to measure application of nutrients as per water quality guidelines. Studies such as the "On Farmers Ground" (OFG), 2002, looked at the demographics, logistical settings, and nutrient management behavior of farmers in relation to manure application, crediting of manure, and over application of phosphorus in a watershed setting. The study concluded that regional differences throughout Wisconsin impact fertilizer-manure- legume management for dairy farms as measured for compliance of Nutrient Management Standards (Powell, Jackson-Smith, McCrory, Saam, & Mariola, 2007).

In 2001, University of Wisconsin-Extension joined the Discovery Farms program with a purpose to research and educate through the use of "unbiased water quality information from different types of farming systems" ("About Discovery Farms," 2014). The program mission includes implementation of effective environmental management practices that are compatible with profitable agriculture.

Supporting research and resulting educational programs continue to address the theory that if the farmer were educated to associate soil testing and analysis as a decision- making tool to

manage nutrient application, non-point water pollution would decrease. The DATCP's Wisconsin Nutrient Management Update annually presents the status of nutrient management planning in Wisconsin. A Nutrient Management Plan is required for those farms causing significant discharge, being regulated by WDNR permit, local livestock siting or manure storage ordinance, participating in the Farmland Preservation Program, or accepting related nutrient management cost-share funds. Farmers that do not fall into these categories may not be afforded the same level of educational support to implement soil testing as part of their sustainable agronomic system.

Educational evaluation and measures of success have indicated that method of outreach has an impact on adaptation of nutrient management as a practice including the supporting practices of soil testing and analysis. "Diffuse communication " vs. "one on one information transfer" have been evaluated to indicate that targeting the on farm needs with direct contact are more likely to have an impact on adopting change in practices, soil testing being one of those practices (Shepard, 1999). This particular research again was reflective of effective educational outreach for water quality programs, tangentially related to agronomic education for soil testing, analysis, and implementation of recommendations.

Research presented by Genskow (2012) concluded Nutrient Management Farmer Education (NMFE) programs are effective in helping farmers understand nutrient management planning and even accounted for an increase in the frequency of soil testing. Farmer attitudes towards regulation, risk of yield loss, and expense to follow some of the nutrient management guidelines, (i.e. soil testing) proved to be ameliorated by the education process. How do these same attitudes by farmers and agricultural educators impact the current education and outreach programming for those who do not voluntarily engage in NMFE or apply a plan to manage their nutrient inputs? As indicated in the study, adopting and implementing practices requires more than completing a plan. It is complex

and relies on outreach, education, and individual consultation between the farmer and the agriculture educator. The study was conducted in relation to the change of behavior to support more effective environmental and water quality efforts (Genskow, 2012). Could the same be true for sustainable agronomic measures?

The literature for Wisconsin nutrient management planning education and thus soil testing by association indicates that although there is a positive impact on implementation, most of the recent studies have been considered outcome based on water quality. There is a correlation reported of "one on one "programing and farmer engagement as effective in achieving outcomes (Shepard, 1999).

Chapter Three: Methodology

To better understand the status of soil testing outreach and education by agriculture educators and Certified Crop Consultants in Wisconsin, an online survey was developed and utilized. The survey was provided to all UW-Extension Agriculture and Natural Resources Education educators located in county offices throughout the state. The survey was designed to help explore:

- Background knowledge of educators on their understanding of nutrient management plan components.
- Perceived demographics of farmers, type of agriculture practiced, and certain physical land characteristics for the county served.
- Types of education, outreach, and expectations employed by the educators and to what purpose/outcome.
- Water quality education, regulations, and incentives in the survey area and perceived impacts on farmer understanding and implementation of nutrient management.
- The agronomic education program in the survey area and perceived needs of the farmers.
- Attitudes of value/purpose of soil testing.
- Description of measures of success for nutrient management, soil testing, and/or soil fertility programs.

The survey instrument was developed, offered, and analyzed using Qualtrics Survey Software. The UW-River Falls and the UW-Extension Internal Review Boards were engaged in the approval process each providing approval for the Protection of Human Subjects (Protocol numbers #H2015-T129 and # 2015-35 respectively). The questions were designed with input of UW-Extension soil

science specialists and Wisconsin Department of Agriculture Trade and Consumer Protection Nutrient Management program staff. A copy of the survey questions is included in Appendix B.

The survey was sent to the educators via the UW-Extension Agriculture and Natural Resources list serve. The survey was open from July 13th- July 31st, 2015. Participants received 2 reminders. Of the 81 survey's delivered, 28 completed responses were returned (35%).

Chapter Four: Results and Summary

The results from the on-line survey are indicated under the conceptual categories in which they were asked (below). The figure representing the survey data and summary follow.

Extension of Nutrient Management University Research to Farmers

The following figures represent the five survey questions developed to capture the methods of nutrient management outreach as well as indicators of how the farmer is engaged in that outreach.

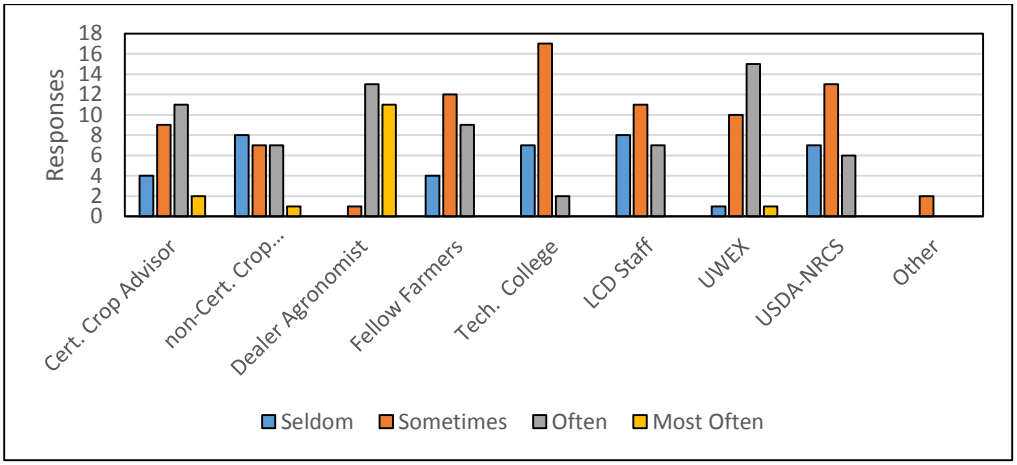

Figure 1. Sources farmers in the county get their information about soil sampling, laboratory analysis and soil fertility recommendation. (n=27)

Educators perceive farmers receive their soil sampling, analysis, and soil recommendation information often and most often from Certified Crop Advisors (CCA) associated with a cooperative or fertilizer dealer. This was followed most closely by UW-Extension as the perceived source of information about the subject

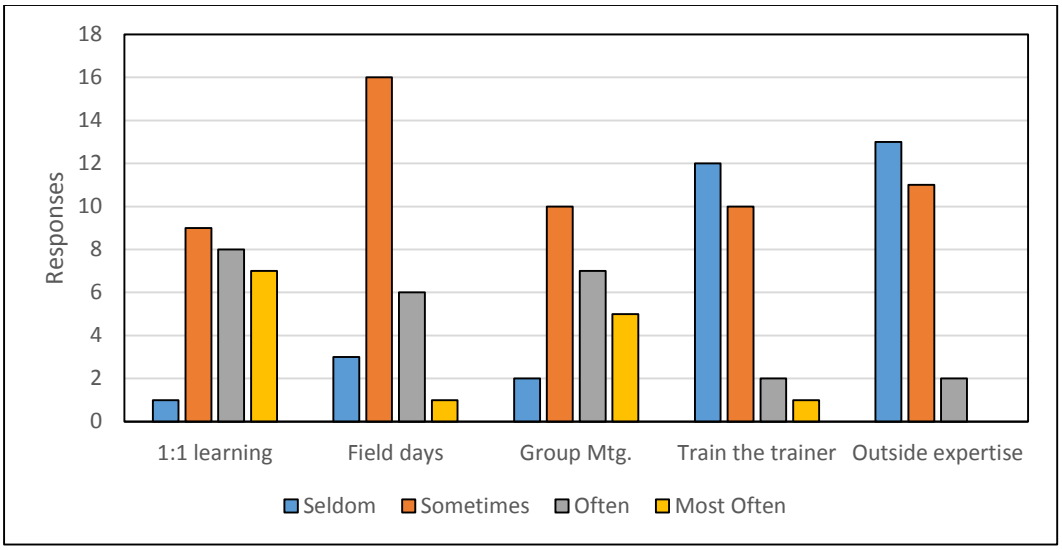

Figure 2. When teaching the concepts of soil sampling, laboratory analysis, and recommendations farmers rely on these methods. (n=27)

Educators indicated that they utilize "one to one" learning opportunities and less often group meetings when they are teaching the concepts of soil sampling, analysis, and recommendations to farmers in their county.

Response		Frequency	%
Seldom		3	11%
Sometimes		16	59%
Often		6	22%
Most Often		2	7%
Total		27	100%

Figure 3. Frequency farmers surveyed typically collect their own soil samples and send to the soil laboratory for analysis.

Response		Frequency	%
Never		3	11%
1-5 times		14	52%
5-15 times		8	30%
Greater than 15 times		2	7%
Total		27	100%

Figure 4. In the past 5 years, farmers in the county have had the option to participate in a Nutrient Management Planning class resulting in a certified Nutrient Management Plan.

Respondents indicated that 30% of farmers more often than not collected their own soil samples for analysis vs. 70 % who may occasionally collect their own samples. Most educators indicated that the farmers had the opportunity in the past 5 years to participate in a nutrient management planning class.

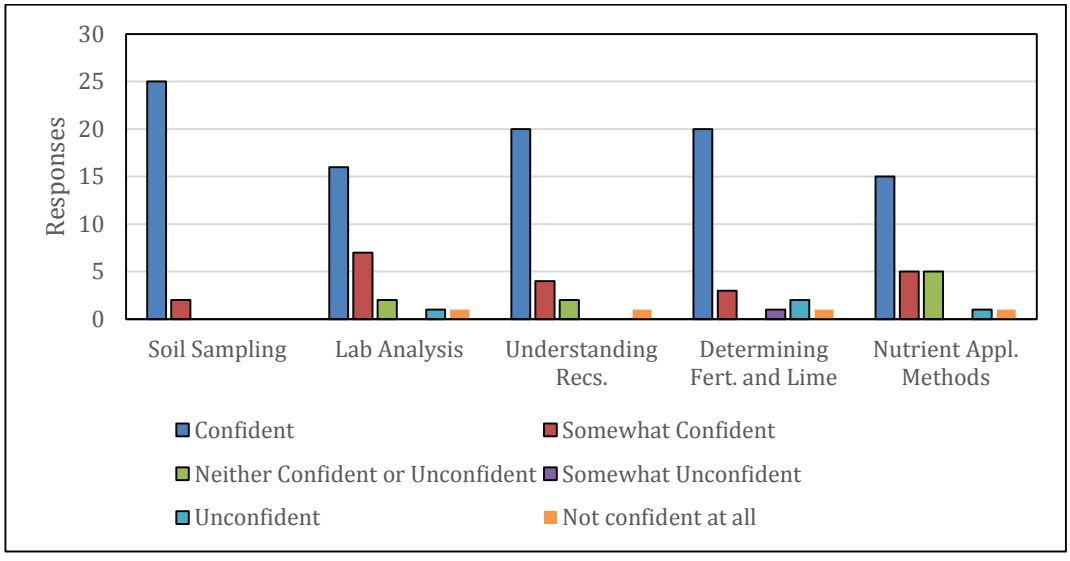

Figure 5. How confident are you in teaching the various components of nutrient management? (n=27)

Educators indicate great confidence about teaching concepts of soil sampling, lab analysis, determining fertilizer and lime rates, understanding recommendations, and applying fertilizer according to best management practices.

Farmer Interest in Educational Efforts Relating to Nutrient Management.

The following six questions were developed to learn the perceptions of the educator as to why and how nutrient management is important to the farmer. What influences the farmer's desire or need to learn?

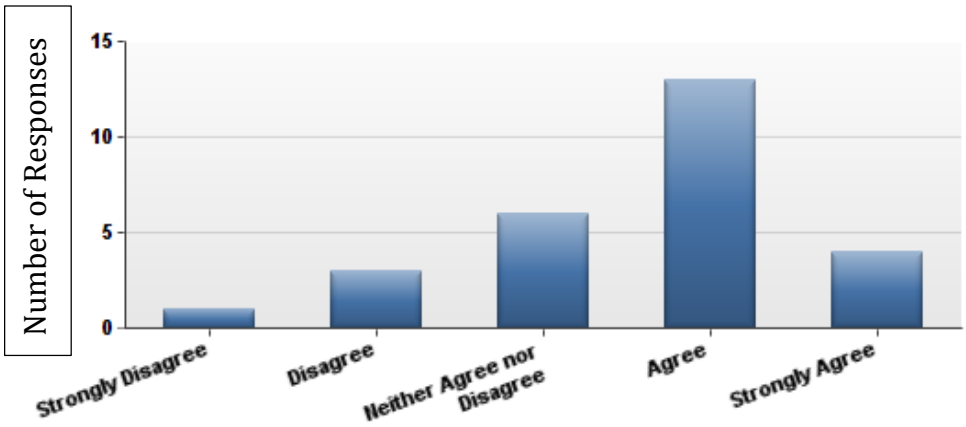

Figure 6. If regulation or cost-share did not provide an incentive, farmers in my county would be less likely to pursue soil tests and follow recommendations. (n= 27)

Most educators indicated that if regulation and cost-share did not provide incentives, famers would be less likely to follow soil nutrient recommendations. (>60 %).

Response		Frequency	%
Strongly Disagree		1	4%
Disagree		5	19%
Neither Agree nor Disagree		8	30%
Agree		12	44%
Strongly Agree		1	4%
Total		27	100%

Figure 7. Farmers who develop Nutrient Management Plans regularly update their plans every 4 years or less.

Response		Frequency	%
Strongly Disagree		0	0%
Disagree		2	7%
Neither Agree nor Disagree		7	26%
Agree		18	67%
Strongly Agree		0	0%
Total		27	100%

Figure 8. Farmers follow their soil test recommendations for the most part.

It is agreed by most of the respondents that farmers who do develop a Nutrient Management Plan regularly update their plans and that they follow their soil test recommendations.

Response		Frequency	%
Strongly Disagree		2	7%
Disagree		12	44%
Neither Agree nor Disagree		8	30%
Agree		3	11%
Strongly Agree		2	7%
Total		27	100%

Figure 9. If there were no federal, state, or local requirements for Nutrient Management Planning, I would change how I taught soil fertility management.

Educators tend to disagree eliminating federal, state, and local requirements would change their strategy for teaching nutrient management, though results indicate this is not without outliers at either end of the spectrum.

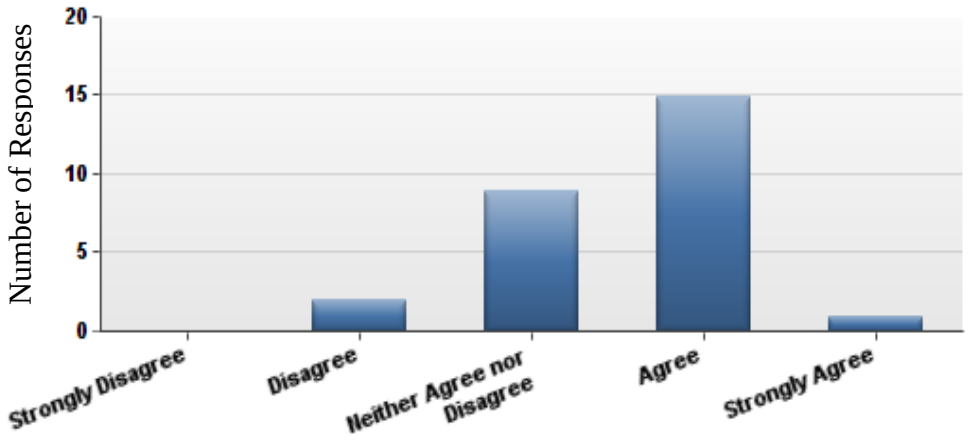

Figure 10. Survey responses indicated an increase in testing for sulfur and/ or micronutrients in the county. (n=27)

To learn if farmers follow recent suggestions by UW-Extension to test for sulfur and certain micro-nutrients, county educators were asked if they saw an increase in such testing. The responses indicate an increase in such testing has been noticed.

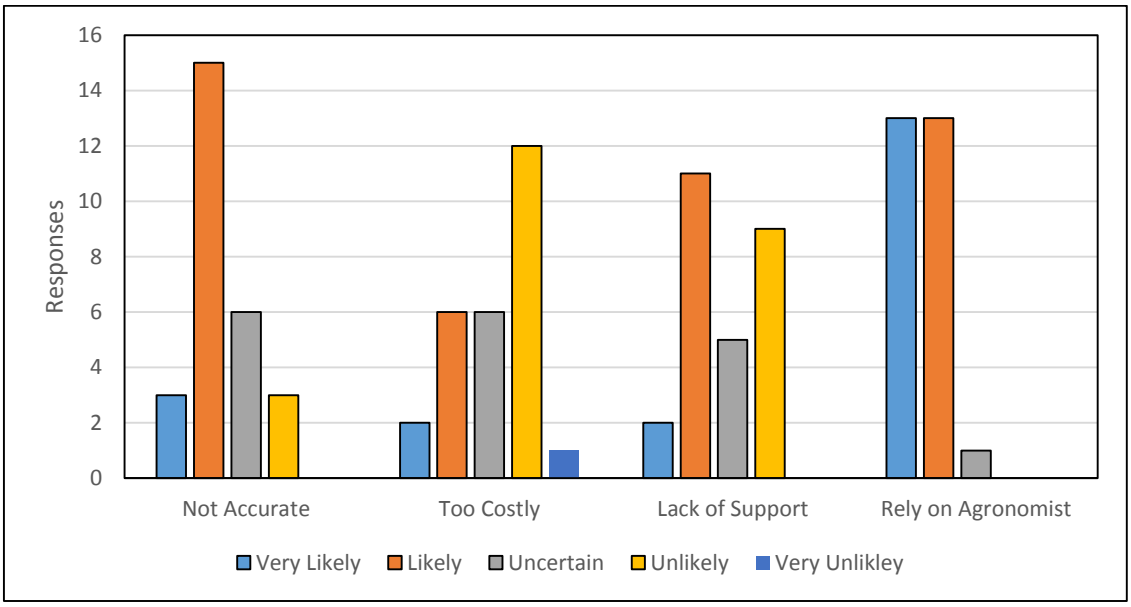

Figure 11. Potential reasons farmers may not choose to follow the University recommendations. (n=27)

When asked why farmers may not follow university recommendations educators indicated that farmers are mostly satisfied to rely on their fertilizer dealer or cooperative agronomist for this information. This reflects responses above that suggest farmers receive most of their agronomic information for nutrient management from their cooperative agronomist or fertilizer dealer.

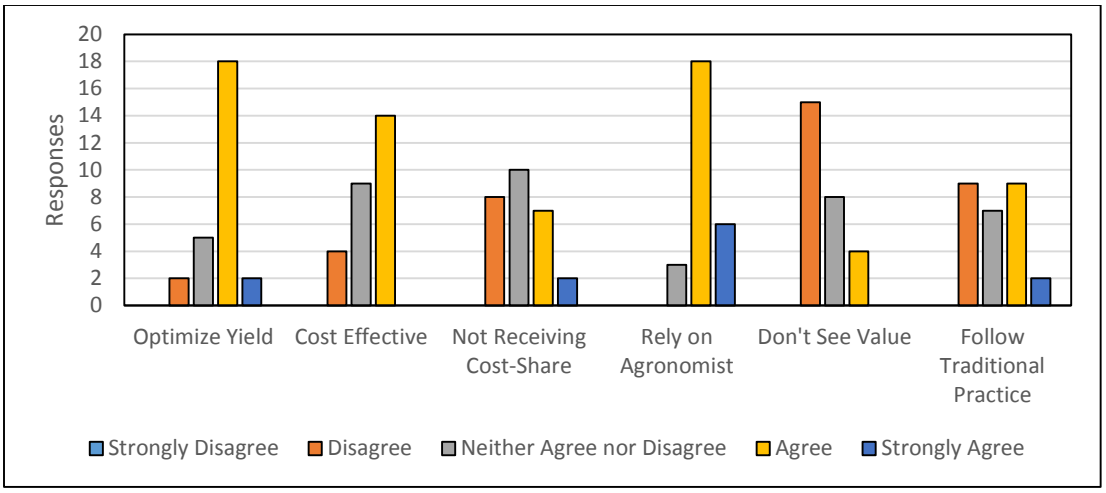

Figure 12. What is the farmer's perception about soil testing as part of a crop management routine? (n=27)

Responses indicate the perception that farmers trust their fertilizer dealers and cooperative consultants when determining the value of soil testing as a tool for crop management. They also responded that most farmers agree that soil testing is important to achieve yield goals and is cost effective. Fewer agree that farmers consider soil testing and analysis as not worthy of their time, effort, or money.

Perceptions of Nutrient Management Education in Relation to Agronomics and the Environment.

When asked how they measure the success of their nutrient management program, "farmer satisfaction with service and outcome" was selected often or most often, followed by number of plans completed. Public perception of water quality degradation was seldom used as an indicator.

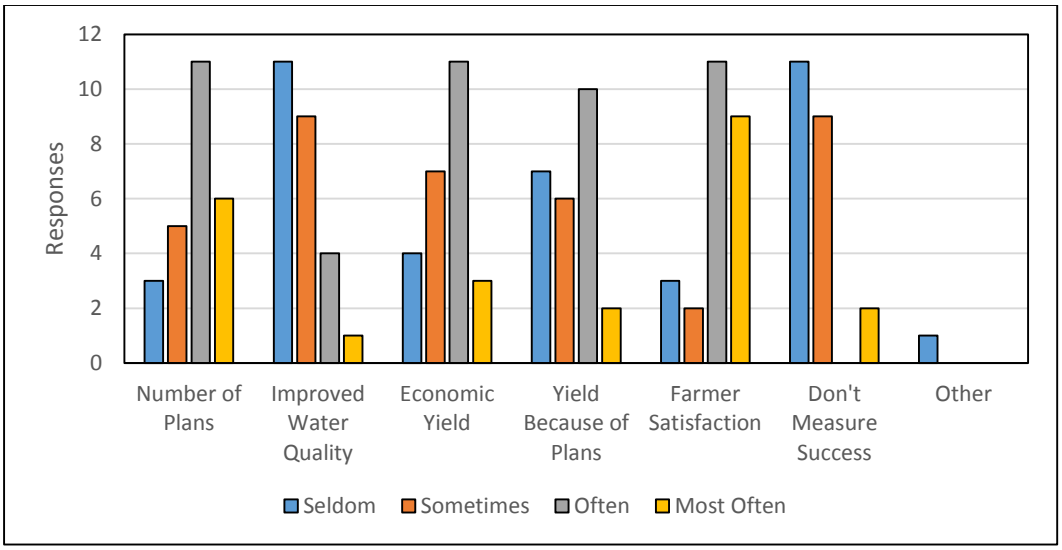

Figure 13. How do you measure success for the nutrient management education and outreach program in your county? (n=27)

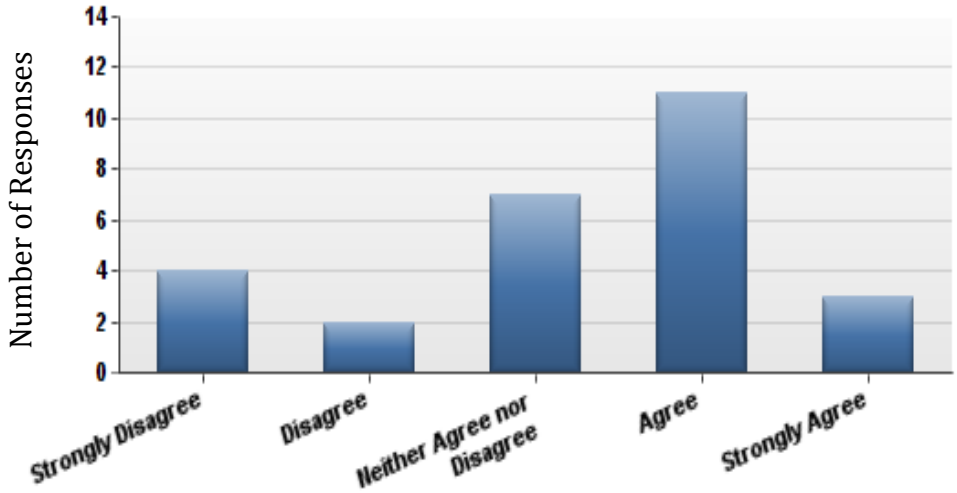

Figure 14. The UW-Extension should consider our education and outreach regarding soil testing and soil nutrient management recommendations to focus primarily on economic yield goals. (n=27)

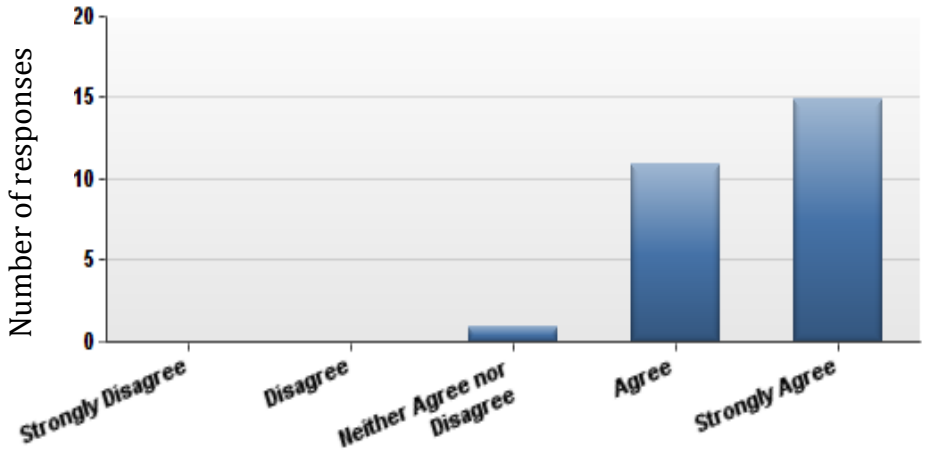

Figure 15. Soil testing is an essential tool for agronomic input management. (n=27)

Educators tend to agree that soil testing and nutrient management recommendations should be taught to the farmers through the lens of economic yield goals.

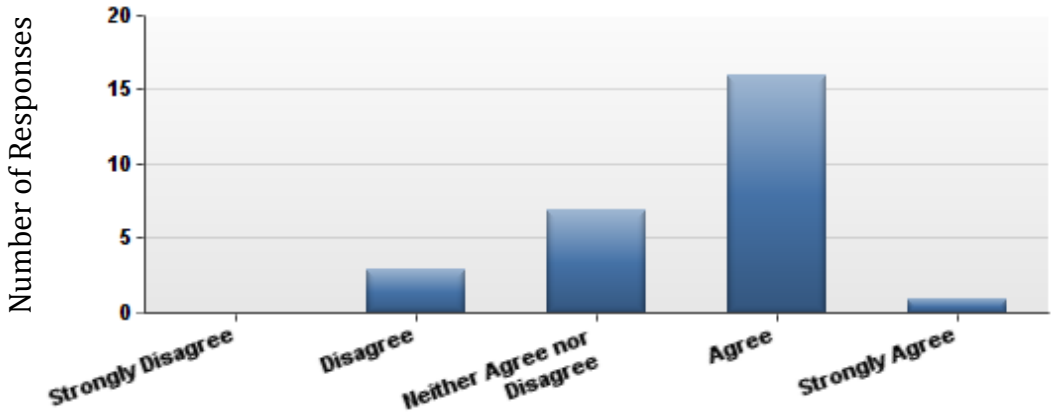

Figure 16. Farmers utilize soil tests and soil analysis recommendations to remain in compliance with their Nutrient Management Plans, and otherwise would sample, test and follow recommendations with less frequency and attentiveness. (n=27)

Again, most educators have the perception that farmers agree or strongly agree that soil testing is an essential tool for agronomic input management. However, educators also more likely agree that farmers would not be so attentive to following nutrient management plans if compliance was not required of them.

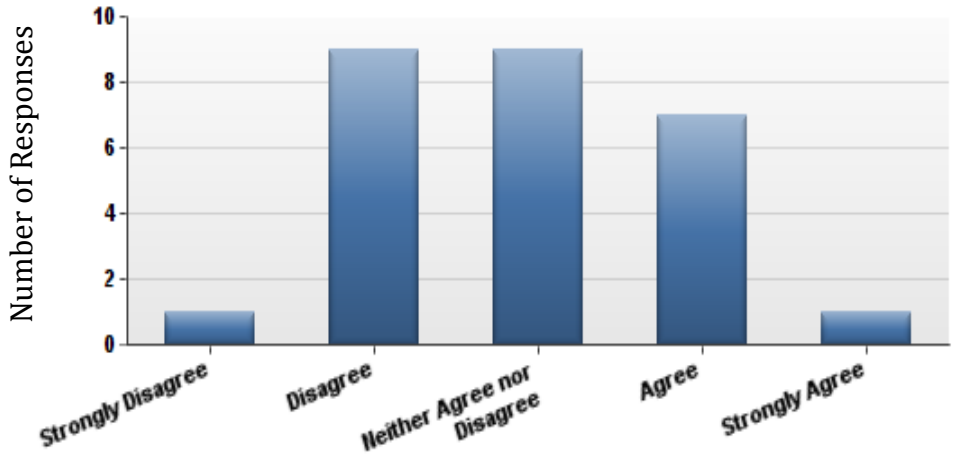

Figure 17. Farmers associate following soil test recommendations with managing water quality. (n= 27)

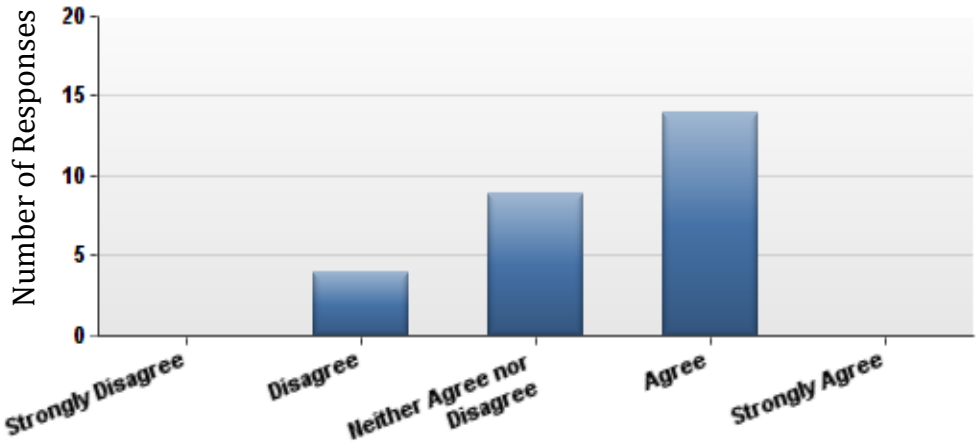

Figure 18. Farmers believe there is significant economic benefit to soil tests beyond qualifying for programs/cost share. (n=27)

When asked if farmers in their county associate soil test recommendations with water quality, educators are slightly more likely to disagree than agree. Educators respond that these same farmers only slightly agree there is significant economic benefit to soil testing beyond qualifying for programs or complying with regulations.

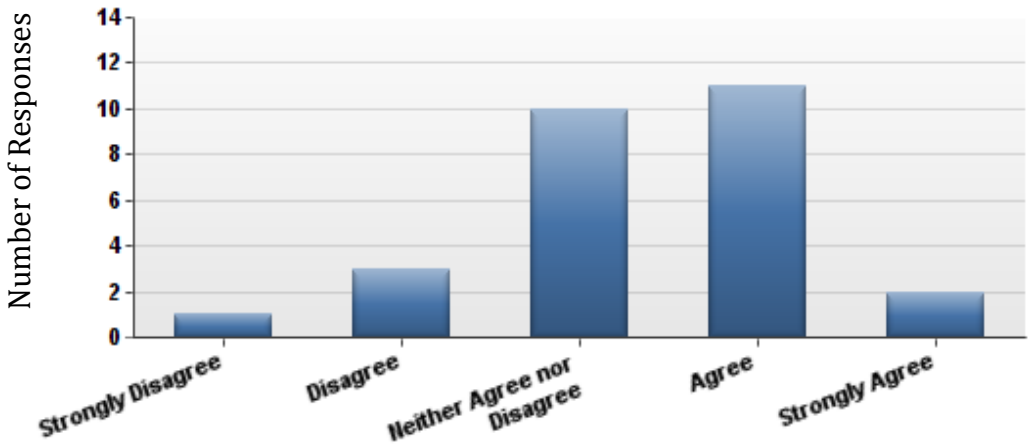

Figure 19. Farmers that follow a Nutrient Management Plan required for cost-share or regulation have a better grasp on economic yield goals and how to interpret a soil test recommendation than those that are not required to follow a Nutrient Management Plan. (n=27)

When asked to consider if those farmers who do follow a nutrient management plan to comply with cost-share or regulation have a better understanding of yield goals and soil test recommendations than those who do not, educators agree though with a high indication of ambivalence.

Educator Perception of Farmer Demographics and Agriculture Systems.

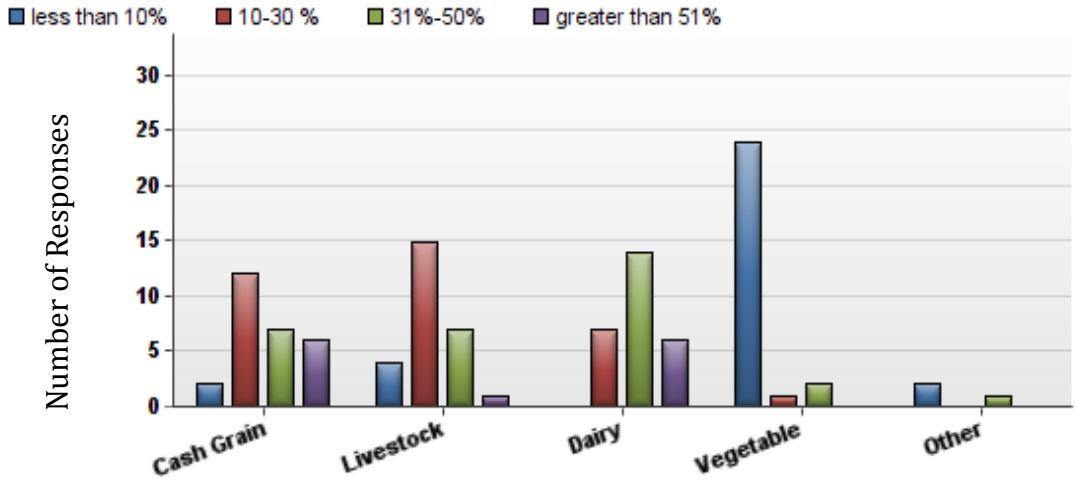

Figure 20. Farmland utilization in the county. (n=27)

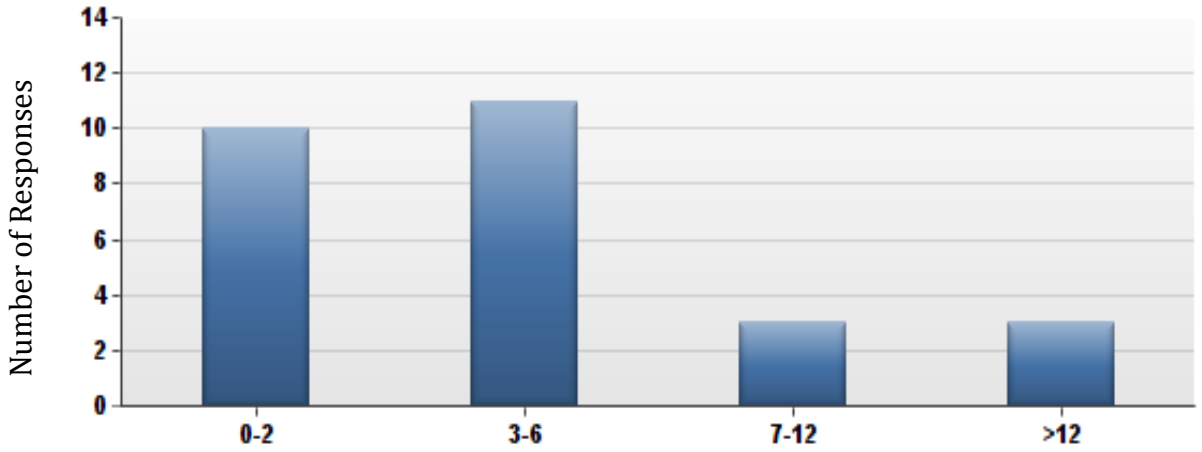

Figure 21. How many Confined Animal Feeding Operations are located in your county? (n=27)

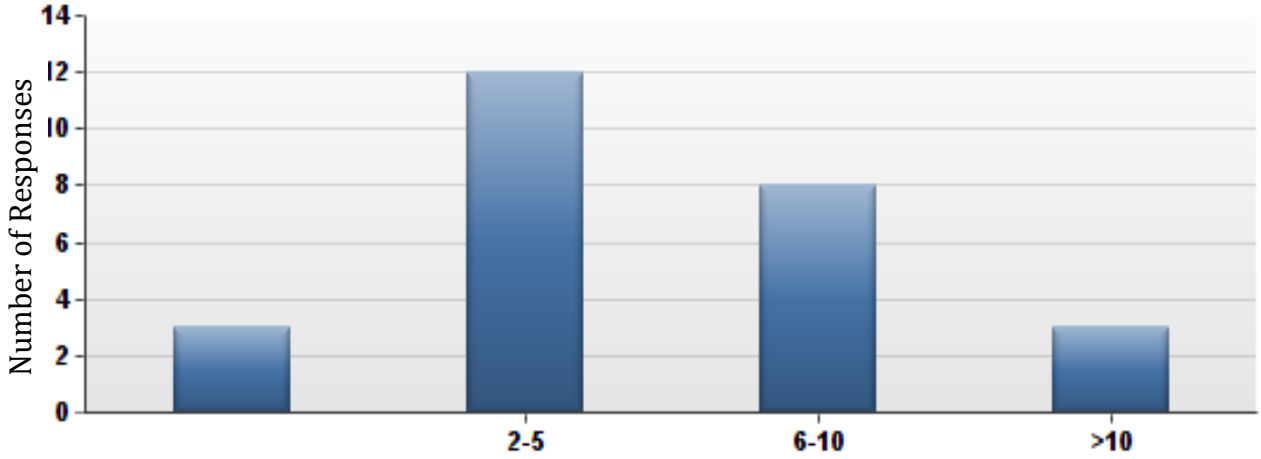

Figure 22. How many Certified Crop Advisors are writing Nutrient Management Plans in your county? (n=27)

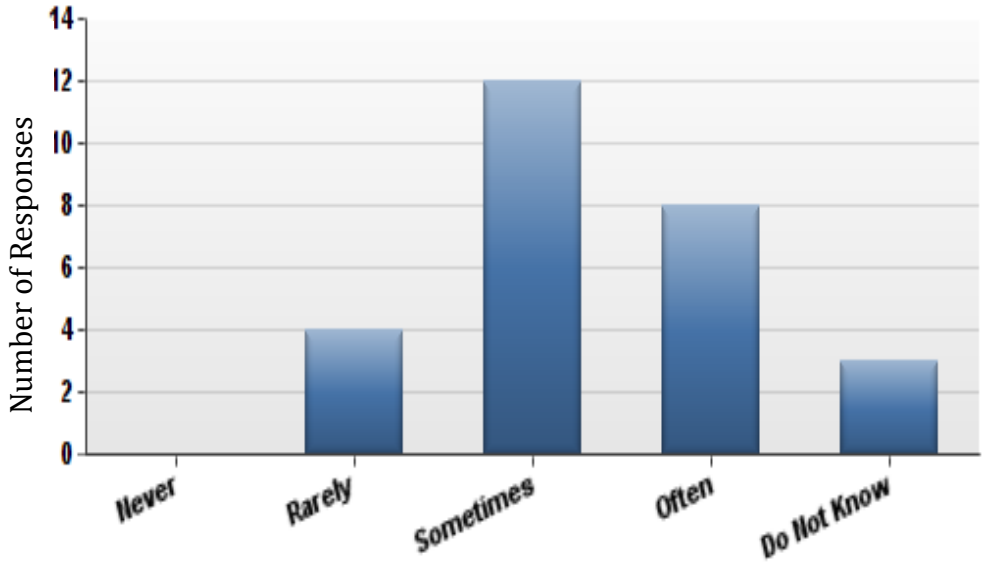

Figure 23. Farmers who send soil samples to a laboratory for nutrient analysis also send forage samples to the lab for nutrient analysis. (n=27)

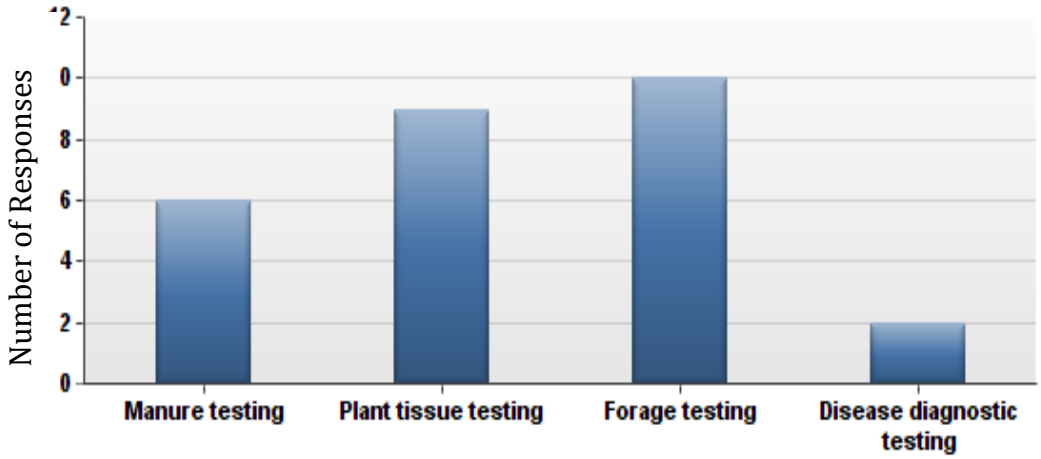

Figure 24. In addition to soil testing, farmers use the following tests: (choose two (2) that are most likely to apply in your county. (n=27)

Dairy and cash grain operations made up the highest percentage of farmland for those educators responding. Most of the respondents worked in counties that had 0-6 confined animal feeding operations. Certified Crop Advisors are writing plans in most of the counties, with at least 2 CCA's in these counties. In addition to soil samples, farmers are perceived to send in forage

samples to a lab for nutrient analysis at least at some times. Soil testing, forage sampling, and plant tissue testing are perceived to be of the top 3 diagnostic tests to be used by farmers.

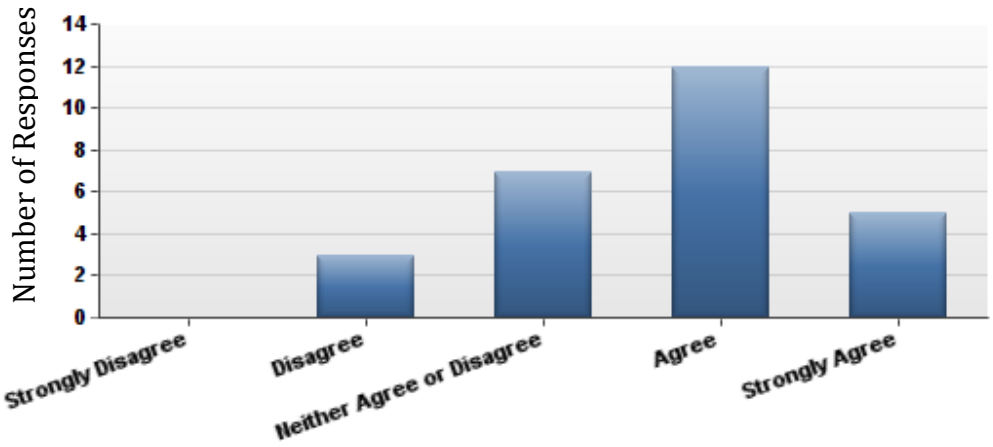

Figure 25. The conventional farmers in my county are more likely than certified organic farmers to test their soils. (n= 27)

There is a belief that certified organic farmers are less likely than conventional farmers to test their soil following UW recommendations.

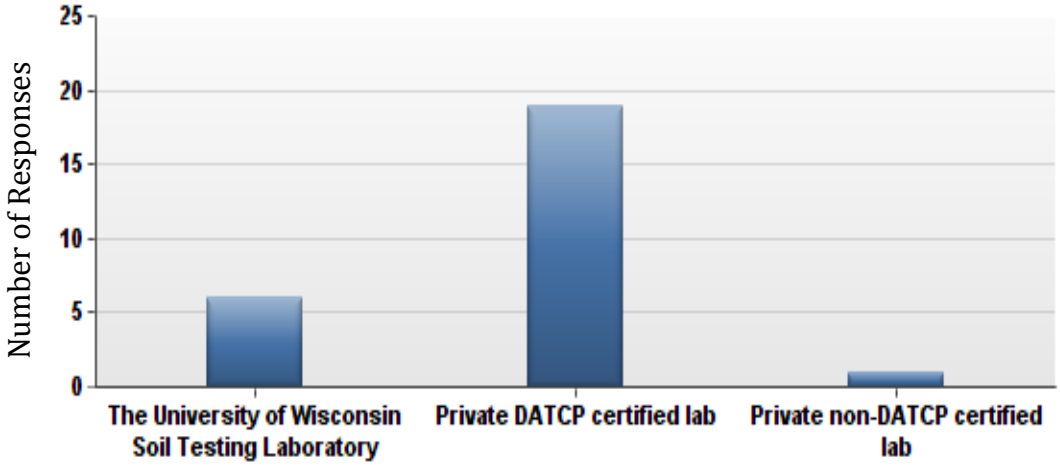

Figure 26. Farmers are most likely to send their samples these labs. (n=27)

Regarding lab services to which farmers send their samples, educators indicate that private Department of Agriculture, Trade, and Consumer Protection certified labs are relied upon over the UW Soil Testing Lab.

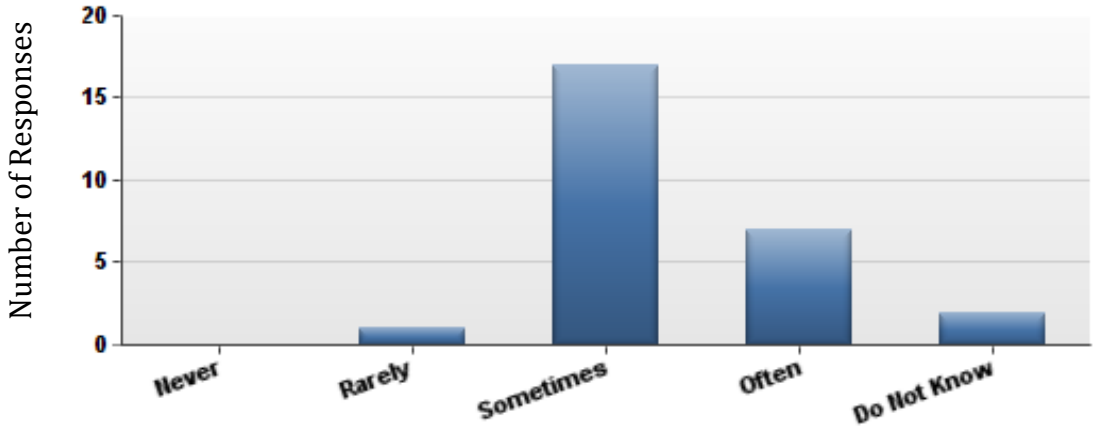

Figure 27. The farmers that test their soils also follow the University recommendations. (n=27)

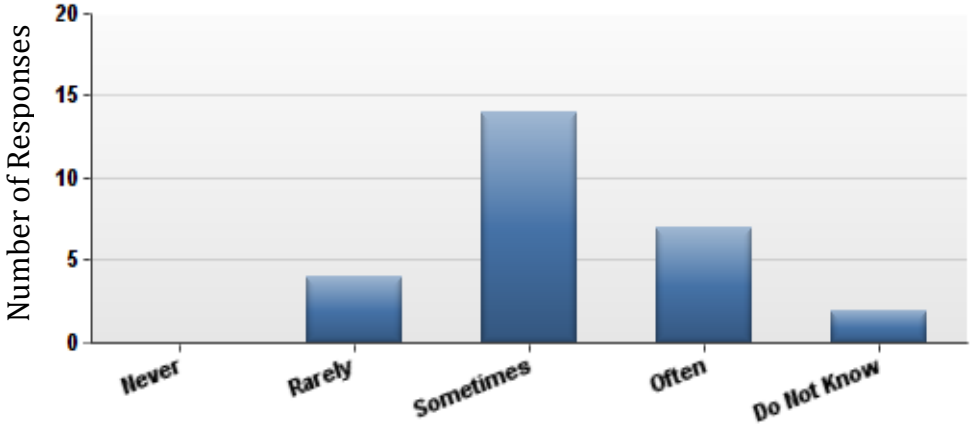

Figure 28. Most farmers maintain a regular soil testing rotation (Testing each field every 4 years) (n=27)

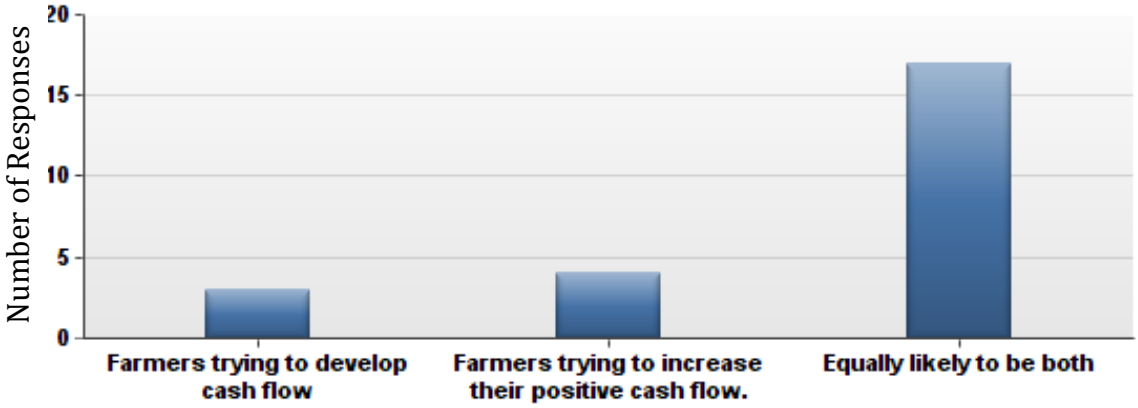

Figure 29. Farmers that tend to utilize UW-Extension education and outreach support for their farming operations are most likely to be farmers trying to increase their cash flow, increase their positive cash flow, or equally likely to be both? (n=27)

Farmers that do test their soil sometimes follow UW Extension recommendations and sometimes maintain a regular testing rotation. They are likely to utilize UW Extension education outreach and support equally to both establish and increase cash flow for their operation.

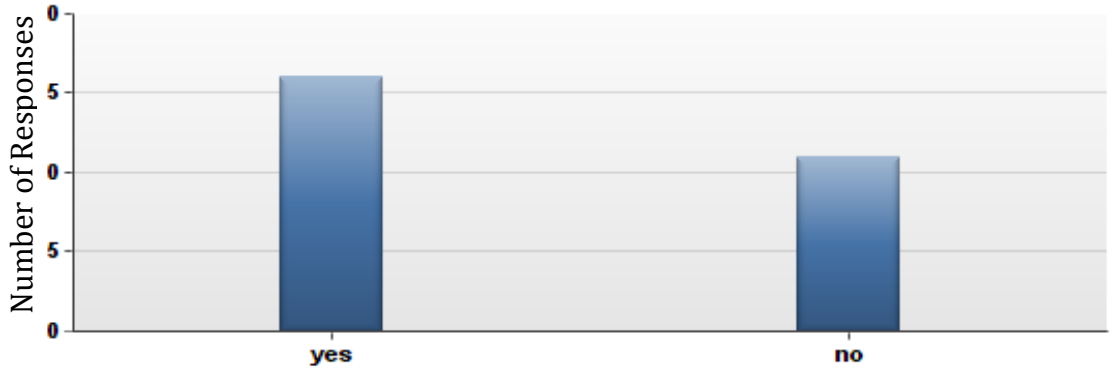

Figure 30. Is there karst topography or shallow to bedrock geology (<2 feet) in your county? (n=27)

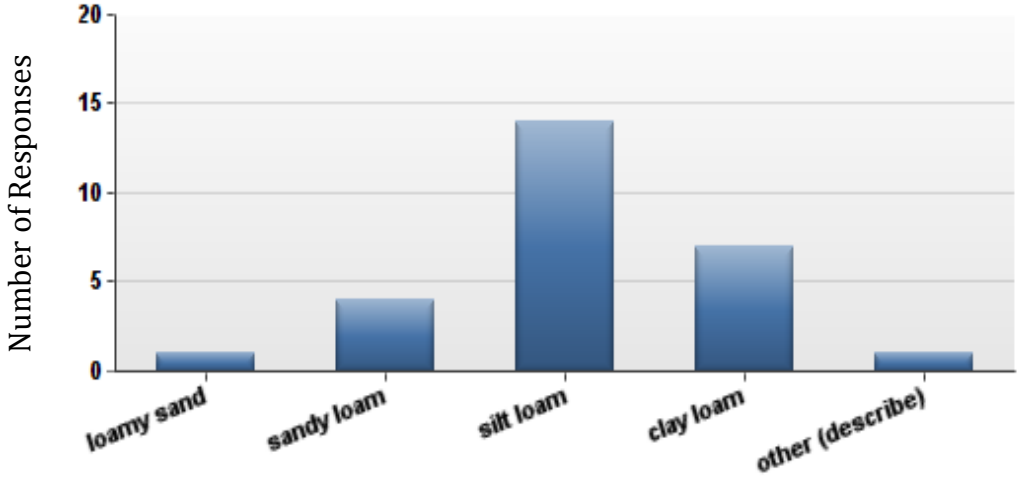

Figure 31. The predominate surface soil texture of the agricultural land in your county is: (n=27)

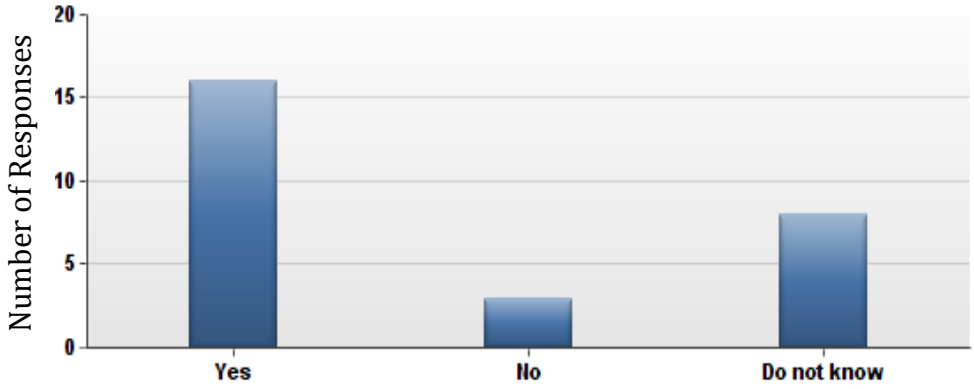

Figure 32. Does your county have a water body on the EPA Impaired Waters 303 (d) list? (n=27)

In relation to the land that is being farmed, slightly over half of the respondents indicated there is karst topography or shallow to bedrock geology in their county. The predominate soil texture of the agricultural land is silt loam. Most indicated that they do have a water body on the

EPA Impaired Waters list, but nearly a third did not know if there was or was not a listed water in their county.

Figure 33. What is your estimate of the percent of farmers participating in USDA-Farm Service Agency programs? (n=27)

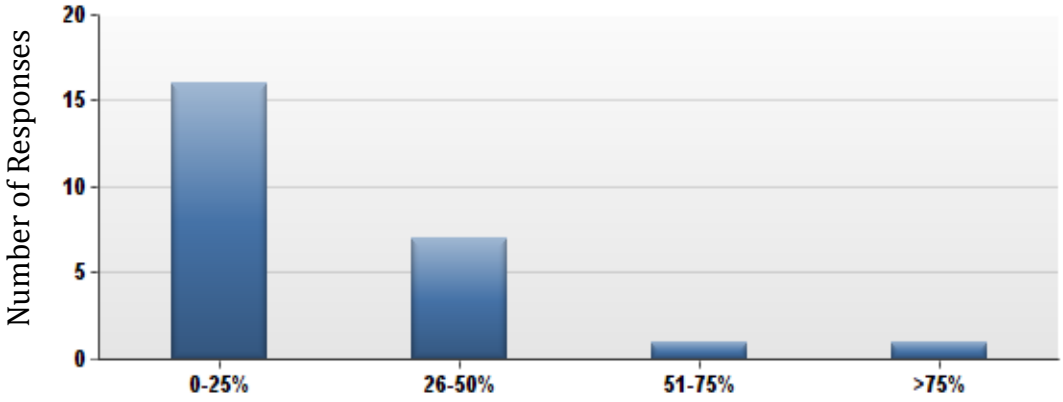

Figure 34. Of those farmers who do not participate in USDA –Farm Service Agency programs, what do you perceive is the percentage that regularly tests their soils? (n=27)

Most respondents' estimate over 51% of famers in their counties participate in USDA-Farm Service Agency programs. Of those farmers who do not participate, most are suspected to not regularly test their soil.

Field of Study

Undergraduate	Graduate
Soils	Soils
Agriculture Business	Soil Science
Agriculture Education	Communication
Ag Education	Plant and Soil Science
Ag Ed	Ag Business
Plant science	Agronomy
Horticulture, UW River Falls	
Dairy Science	Animal Science
Ag Ed	Adult Ed
Crops and Soils	Agriculture Education
Farm management	Agronomy
Farm Management/An Science	Agronomy
Animal Science	Adult Education
Agriculture Education	Agriculture Education
Soils	Soils
Animal Science	Agriculture Education
Animal Science	Agriculture
Biology	
Biology	Agro ecology
Ag Education	Education
Dairy Science	Dairy Science
Ag Education	Ag Business Mgmt.
Ag Ed	Ag Ed
Ag Education	Ag Engineering
Ag Econ	
	Agricultural Economics

Figure 35. UW Extension Educator's reported major field of study: (n=27)

The educators identified themselves as having undergraduate degrees of nearly half animal, crop, and soil science and half agricultural business /economics and agricultural education. The same was true for graduate degrees. Nearly half were agricultural education/agricultural business and the remaining crop, soil, and animal science.

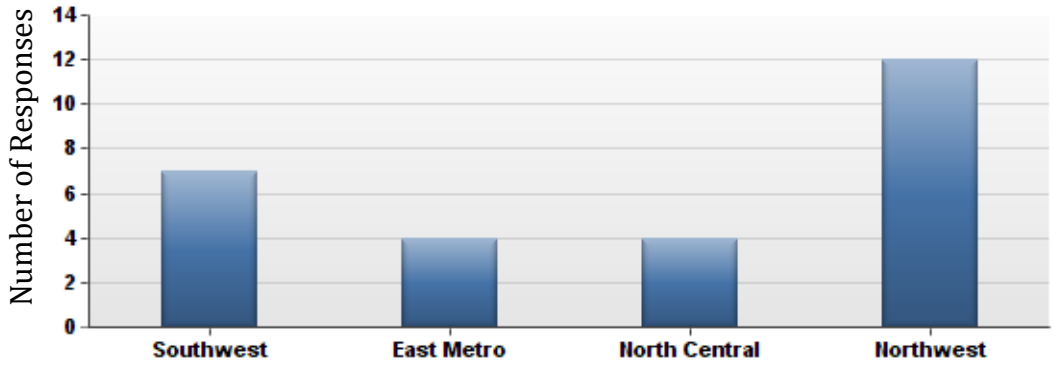

Figure 36. Administrative Region of UW-Extension represented in the survey. (n=27)

The distribution of participants was divided into the four UW- Extension administrative regions of the state. Of these regions, most participants are from the Northwest Region.

Chapter Five: Discussion

For the purpose of this study, it is useful to review certain responses in relation to others. In so doing we can consider how nutrient management education is influenced and perhaps linked to educator perceptions of the purpose, value, knowledge, and farmer understanding of nutrient management education, including soil testing, analysis, and implementation of recommendations.

Characteristics of the Land, Farmer and Educator

The response to the survey offers a fairly diverse view of the agricultural landscape in terms of geology, soil texture, and regulated surface waters. Responses came from all regions of the state, though the Northwest Region was over represented in relation to the other regions. The relatively small sample size leaves analysis of different cropping systems or regions of the state inconclusive.

Educator's degree backgrounds are diverse enough to have a good representation of technical background. With a nearly 50% representation of both hard science and social science degrees among the participants it would be interesting to understand how degree types and area of expertise impacts nutrient management education.

Questions asked to learn the perception of the participation of farmers in government programs and management practices offered some insight into what their interaction may be with the more progressive style of agricultural management. There tended to be enough diversity in all these questions of land, farmer, and educator characteristics that it was not so useful to create distinctive groupings to analyze differences.

With that in mind, there are items of note within the demographic portion of the study that deserve comment. Farmers are perceived to utilize manure testing with less frequency than plant and forage sampling. Since nutrient management is intensively tied to manure handling and nutrient credits from manure it could be expected that manure sampling would be utilized for both

agronomic and water quality management support at higher levels than perceived. (Fig. 24) This may reflect the value that farmers and the UW- Extension place on forage sampling for the nutrition and milk production of their livestock, particularly dairy. The number of responses may not have been able to capture the impact of the dairy farmers and their use of manure testing. Indeed forage sampling is a highly rated diagnostic tool for Wisconsin farmers. For nutrient management planning, a "book value" for manure is readily available and so can be used in place of actual tested manure.

It is not surprising that most of those surveyed perceive that farmers most often submit their samples to DATCP certified labs versus the UW- Extension Lab. These non-public labs are managed for profit and serve the cooperative agronomists and CCA's who are indicated as the perceived choice of farmers for nutrient management advice. As a matter of extension, there is value for educators to have a working relationship with the CCA's and cooperative agronomists who work most closely with the DATCP certified private labs. Through association, these labs, CCA's, and agronomists have relationships with the farmer that is trusted and valued. These characteristics are indicated in the literature as those necessary to gain trust on the way to an enhanced learning environment. Likewise a mission of the UW- Extension soil-testing program is accuracy and efficacy of soil testing analysis. This is an important support for the private labs. The UW and DATCP labs have a collaborative role in nutrient management application and can be a significant inroad to delivery of nutrient management components, including education.

To understand how the value of nutrient management may be associated with water quality, educator's response to perceived value of nutrient management of the farmer was cross- referenced with land sensitivity to nutrient loading. The two land characteristics used to measure sensitivity to nutrient loading were presence of karst topography /shallow to bedrock geology and presence of

surface waters on the EPA Impaired Waters 303(d) list. The hypothesis suggested educators in counties with sensitive land perceive farmers place a higher value on nutrient management for water quality than those farmers that do not farm in such counties. The results indicate that within the sample collected, the null hypothesis is supported. There is not a strong relationship perceived between sensitive landscapes and value of nutrient management for water quality ($p=.61$ and $p=.25$ for bedrock and EPA listed water respectively). This may be attributed to the small sample size or diversity of sample. It would be valuable to explore educator's knowledge and perceptions and farmer's knowledge and perceptions in relation to water quality specifically for these sensitive landscape counties with a larger sample size. If there indeed is not a significant value assigned to water quality impact of nutrient planning in the highly sensitive counties, does this impact how we teach? Does it curtail achievement of water quality goals and by association, agronomic sustainability goals? Do the educators in those counties require different skills and curriculum to extend the water quality value to farmers? There likely is a better way to ask the question and develop the pool to obtain meaningful results.

How are Nutrient Management Components Extended to the Farmer?

Cooperative agronomists are perceived to be the most common provider of soil fertility and nutrient management information and recommendations. This may not be a role to wrestle away from the cooperative agronomists, but rather an opportunity for UW Extension educators to work with this trusted source in delivering outreach and education. For example, educators can make sure that current information is available to the cooperative agronomists at the local level instead of having it filtered down to them from more remote channels. Collaboration between the educators and the private cooperatives in nutrient management programming and research could be mutually

beneficial. Such collaboration may impact trust and confidence in the UW- Extension educator as well as hone the agronomic and water quality message of the cooperative.

There is a perception by educators that farmers are less likely to turn to agencies for their nutrient management information. Indeed the agencies are responsible for regulation, and likely are perceived by educators and farmers to have a mission that could sacrifice economic gains. Since the intended goal of the agencies is mostly water quality improvement, there may also be less technical knowledge of soil fertility, nutrient management, and agriculture economics. This may have an impact on trust and thus ability to educate.

A surprisingly low reliance on addressing educational needs for nutrient management is perceived for the technical colleges, even though many have agricultural education responsibility. This again may be a relationship to explore in developing a strong nutrient management educational program locally. Are farmers not aware of the technical college offerings or do farmers find technical colleges better equipped to address other needs?

It is perceived that more farmers do rely on certified crop advisors vs. non-certified crop advisors. This implies there is a value to continuing education for those delivering nutrient management education. This may be a reflection of trust and/or a higher quality educational experience by the farmer.

Nutrient management education is delivered in various ways. The majority use of a "one on one" educational experience can bode well for trust and confidence building. The perception that there is a limited use of "distributive/innovation –diffusion" teaching (indicated as "train the trainer" in Figure 39) may be a result of farmers not being interested in cooperative learning in a peer to peer situation. Since the expression "distributive/innovation –diffusion" teaching was not

explained in the survey there may have been confusion over what the term meant, and so it was not selected as an answer.

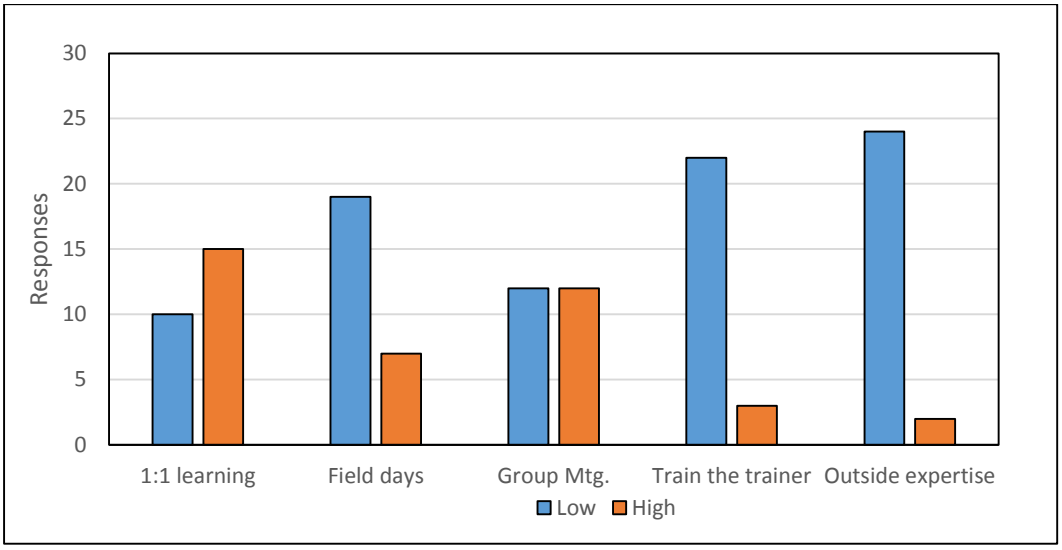

Figure 37. How is nutrient management training offered?

Small group teaching is reported more often than field day events for most educators. It would be useful to know how these methods of 1:1 learning and group meetings vs. field days succeed in delivering the educational goal of nutrient management. As more education is offered remotely via technology these more traditional formats will need to be measured against the increasing standard of outreach.

Looking at the use of Nutrient Management Planning classes as a source of education on the topic, only 10% are considered to have not had an opportunity to take a class in the past 5 years. Such classes are not offered very frequently and are often associated with regulation or cost-share. In this survey it appears that nearly 80% of the farmers are reported to have good access to classes to develop a certified Nutrient Management Plan. Since 80 % of farmers in Wisconsin do not have a certified Nutrient Management Plan it is appropriate to consider what is a reasonable success rate for such classes. Indeed participation in these classes requires a strong commitment by the farmer. If we consider the value that farmers place on components of nutrient management, some with

ambivalence, there may be an explanation as to why there are not more plans completed. Generally the instructors of the class are agency staff, not the most relied on for satisfying educational needs as reported by educators.

Why Is the Farmer Interested in Learning Nutrient Management?

Over 60 % of educators indicated that farmers would be less likely to implement nutrient management practices if cost-share or regulation were not an incentive to do so. This is in spite of the knowledge that most farmers accept proper management of soil nutrients as an economic benefit. Perhaps implementation could be increased if programing aimed at emphasizing the profitability aspects of nutrient management were developed so that farmers and educators acknowledged the dollar value more directly. Assisting the farmer in realizing the value in the short run could potentially eliminate the need to provide cost share of implementation in some cases. Since 30 % of the responses indicated, "neither agree or dis agree", directed education for economic benefit might increase adoption of practices by farmers and result in less ambivalence by educators.

Educators report they would not significantly change how they taught components of nutrient management even if regulations and incentives were removed. This may be related to the confidence that they have in teaching the subject. It may also reflect the notion that measure of success for nutrient management planning is not practiced in a comprehensive and consistent way to determine outcomes of the learning. Most responses indicated that success is measured by farmer satisfaction or number of plans completed. Is the satisfaction measure related to how they were treated in the learning process vs. what they learned? What is the outcome of the learning? Does the number of plans reflect value to the farmer in terms of agronomics or water quality? These questions need to be addressed to adequately measure success of the educational programing.

When asked about sulfur and micronutrients, educators mostly agreed they are noticing an increase in testing. This is significant as the decline in sulfur emissions resulting from implementation of the United States Environmental Protection Agency Clean Air Act is having an impact on adequate amounts of sulfur in the soil. Since sulfur and micronutrients are not regulated via current nutrient management laws, farmers are independently taking the steps to test for these nutrients. This indicates a purely agronomic management decision by the farmer. Indeed recent high commodity prices may have also spurred the awareness of the value in this action of testing for available sulfur.

Educators expect that UW- Extension recommendations are not always followed as most farmers rely on their cooperative agronomist or fertilizer dealer. As noted above, there is a relationship of trust, accessibility, family tradition, and local congeniality that may come into play. It can be considered that UW- Extension educators do not have the local connection even within their county, or that over more recent years the educators are not originally from the county they work in, nor do they stay in one location for as long as their predecessors may have in the past.

Agronomics, Water Quality, or Both?

There is much variability, but most educators respond that the focus of nutrient management education should be on the agronomic value. They clearly understand that soil testing is an essential tool for managing nutrients. This alone is important as an undisputed assertion supported with decades of evidence.

They do, however report that nutrient management plans resulting from regulation would be less likely followed if compliance were not the incentive for the plan. Since these regulated plans are considered to be developed in response to water quality concerns, it can be interpreted that water quality is not as important or not as well understood as agronomic concerns. Are these plans

mutually exclusive? The components for both agronomic and those implemented in response to a water quality concern are the same. The perception of value is clearly different with a third of educator's agreeing that farmers connect water quality to nutrient management, over a third not recognizing a connection, and a third ambivalent. There appears to be a need to continue working with educators, farmers, regulators, and the public to define the association and reach of education for nutrient management and how it is important for water quality. This may be especially true as recent changes to de-regulate and de-fund some aspects of nutrient management and water quality protection in Wisconsin are implemented.

Chapter Six: Conclusion

Perceptions of educators are sometimes consistent with how valuable they consider the components of a nutrient management plan to be. It is suspected by the educators that though farmers believe soil testing, analysis, and following recommendations is of agronomic value, they also believe farmers would not apply these principles if regulations and incentives were not in place. Educators perceive CCA's, cooperative agronomists, and fertilizers dealers are whom most farmers turn to get their nutrient management information. For the sake of agronomic and water quality goals, it is important that educators work with these providers to build trust and extend current nutrient management education. It is also important to consider the needs of non-regulated or incentivized farmers who may not receive the attention of the cooperative agronomists and dealers.

This survey failed to demonstrate a link between the presence of sensitive land features in the county in regards to water quality and the farmer perception of soil testing as a tool to manage for water quality. This may be due to the small number of respondents taking the survey. There may be a belief that regulations and incentives are not responsible for the value farmers place on nutrient management, or at least they do not connect the practice and value of nutrient management with the reason they are provided incentives or are regulated.

The venue or method of extending nutrient management components to the farmer does not appear to impact the educator's notion of how the farmer values nutrient management. Group classroom settings, planning with a CCA, or one on one training all are perceived to achieve the same understanding or level of associated value to the farmer.

It is likely that there is a common ambivalence amongst UW- Extension Agriculture educators, that the education and outreach provided is useful and that farmers place value on nutrient management plans mostly for agronomic purposes. Regulations and incentives provide a reason to comply, but probably have not influenced the ability to understand, extend, or build upon the benefits of the sustainability of the practice.

Further Study

Further study should include an analysis of farmer value and implementation of nutrient management components. If there is a value placed on the practice, how do they value and under what scenarios? It would be important to understand how educators measure success of their teaching in relation to how nutrient management is considered a success by the farmer.

Educators should consider how they provided nutrient management education to farmers who are not in programs, under compliance provisions, or receive cost share. They may be able to increase trust and educational outcomes by collaborating with cooperative agronomists and dealers, making sure they are promoting up to date research and enhancing nutrient management education and water quality outcomes. Aligning UW- Extension locally offered nutrient management education and outreach with the need to raise the non –incentivized and regulated participation in the practice of nutrient management is worthy educational goal. Understanding the current perceptions of the educators of this topic can help to focus such educational plan development and measure of success or outcome.

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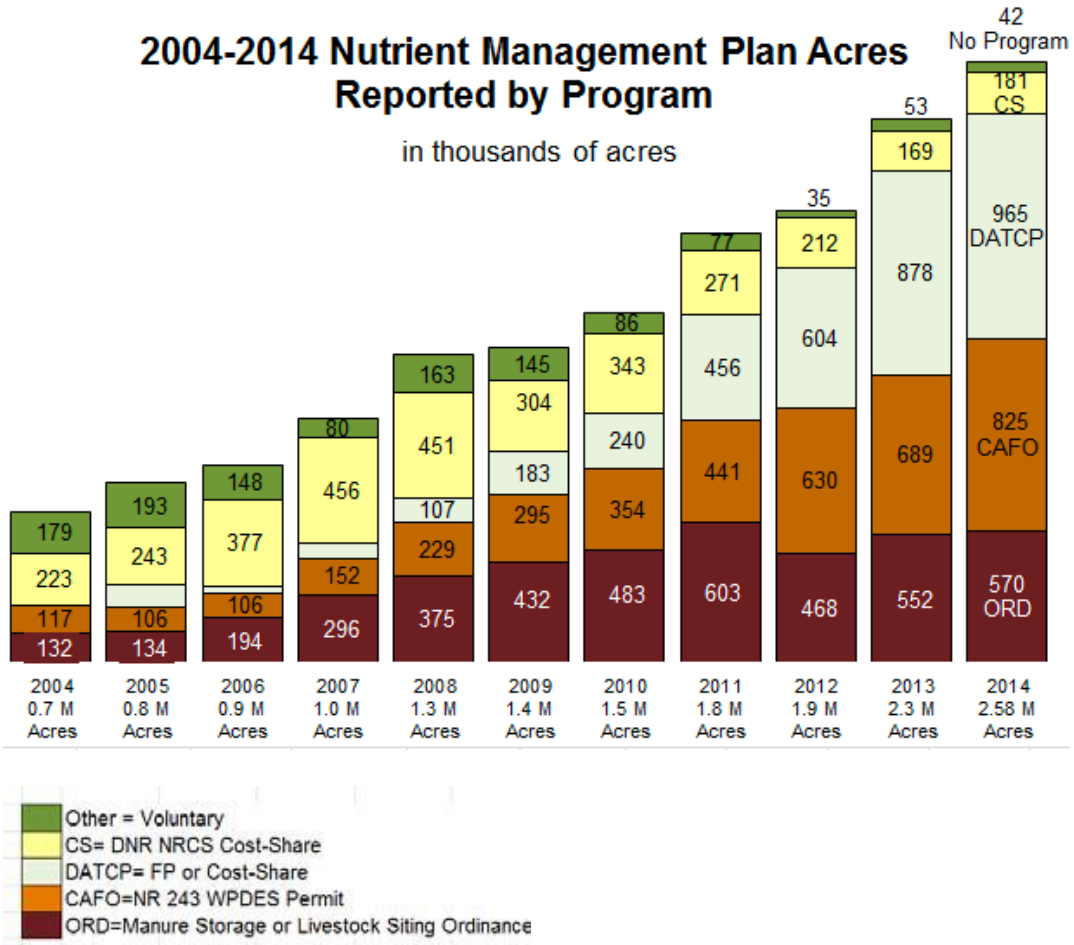
Appendix A

Relative Nutrient Management Plan Completion



From: Wisconsin Nutrient Management Update and Quality Assurance Team Review of 2014's Nutrient Management Plans. (2014). Department of Agriculture, Trade and Consumer Protection.

Appendix B

Survey Questions

Nutrient Management: Status of Soil Sampling, Testing Analysis, and Recommendation Education and Outreach to Wisconsin Farmers by UW-Extension County Agents and Educators

The information gathered in the survey below will inform how nutrient management principles and practices are extended to Wisconsin Farmers as a means to achieve sustainable agricultural goals. A sound soil-testing program has been encouraged by UW-Extension to manage crop yields and economic returns since the 1940's. By the 1970's there was a growing understanding of the relationship between nutrient management, environmental quality and economic sustainability. We are interested in learning how UW Extension Agriculture Educators and Agents offer nutrient management. You will be asked about trends, perceptions, and characteristics of your programs, agriculture and farmers. Your responses are important to achieve a picture of the status and focus of nutrient management outreach and education to Wisconsin Farmers. This knowledge will inform how to refine nutrient management education and address needs of farmers more efficiently with measureable outcomes. You are asked to participate by following the link to complete the questionnaire. Please do not type your name anywhere on the questionnaire. This study is meant to be anonymous; no identifying information will be recorded, including the IP address of the device used to complete the survey. Participation is completely voluntary. If you choose to participate, please answer the questions to the best of your ability. The survey will take you an estimated 20 minutes to complete. Only aggregate numerical data will be presented and any quotations taken from the open-ended questions in the survey will not include potentially identifying information. Although every measure will be taken to assure confidentiality and the risk is very slight, we cannot completely guarantee confidentiality. The results will be presented at the University of Wisconsin Extension Agriculture and Natural Resource Education Conference and will be submitted to the Wisconsin Crop Management Conference. If you have any questions or concerns, please contact Jane Anklam, jane.anklam@my.uwrf.edu, (218-343-8528) or Dr. Tim Buttles, timothy.j.buttles@uwrf.edu, (715-425-3555). If you have concerns about how you were treated in this study please contact: Molly Van Wagner, Director of Grants and Research, 101 North Hall, UW-RF, 715/425-3195. This project has been approved by the UW-River Falls Institutional Research Board for the Protection of Human Subjects, protocol #H2015-T129, and the UW-Extension Human Subjects Protection Review process, Control #2015-35. Please mark YES below if you have read the consent statement above and agree to participate in the survey. If you do not wish to participate in the survey, please mark NO below or close the Internet window.

- ❍ Yes (1)
- ❍ No (2)

If Yes Is Selected, Then Skip To Soil sampling, laboratory test analysis...If No Is Selected, Then Skip To End of Survey

Q2 Soil sampling, laboratory test analysis and resulting recommendations are the foundation of a nutrient management program. How do you extend related University Research to the farmers in your county? Please answer the following questions by indicating how each describes soil fertility management education in your county(s)

Q3 Farmers in my county get their information about soil sampling, laboratory analysis and soil fertility recommendations from:

	Seldom (1)	Sometimes (2)	Often (3)	Most Often (4)
Independent Certified Crop Advisor (CCA) (1)	❍	❍	❍	❍
Independent non-certified crop advisor (2)	❍	❍	❍	❍
Cooperative Agronomist/Fertilizer Dealer CCA (3)	❍	❍	❍	❍
Fellow Farmers (4)	❍	❍	❍	❍
Technical Colleges (5)	❍	❍	❍	❍
Land Conservation Staff (6)	❍	❍	❍	❍
UWEX (7)	❍	❍	❍	❍
USDA-NRCS (8)	❍	❍	❍	❍
Other (Please describe) (9)	❍	❍	❍	❍

Q4 When teaching the concepts of soil sampling, laboratory analysis and recommendations to farmers I rely on the following methods:

	Seldom (1)	Sometimes (2)	Often (3)	Most Often (4)
One to one learning (1)	❍	❍	❍	❍
Field days (2)	❍	❍	❍	❍
Group Meetings (3)	❍	❍	❍	❍
Distributive/ "innovation – diffusion" teaching (4)	❍	❍	❍	❍
Outside expertise (5)	❍	❍	❍	❍

Q5 Farmers in my county typically collect their own soil samples and send to the soil laboratory for analysis.

❍ Seldom (1)
❍ Sometimes (2)
❍ Often (3)
❍ Most Often (4)

Q6 In the past 5 years, farmers in my county have had the option to participate in a Nutrient Management Planning class resulting in a certified Nutrient Management Plan.

❍ Never (1)
❍ 1-5 times (2)
❍ 5-15 times (3)
❍ Greater than 15 times (4)

Q7 How confidant are you in teaching the various components of nutrient management?

	Confident (1)	Somewhat Confident (2)	Neither Confident or Unconfident (3)	Somewhat Unconfident (4)	Unconfident (5)	Not confident at all (6)
Soil Sampling (1)	❍	❍	❍	❍	❍	❍
Soil Test Analysis Protocol (2)	❍	❍	❍	❍	❍	❍
Understanding Soil Test Recommendations (3)	❍	❍	❍	❍	❍	❍
Ordering the Recommended Fertilizer and Lime Quantities (4)	❍	❍	❍	❍	❍	❍
Nutrient Management (rate, timing, source, placement considerations) (5)	❍	❍	❍	❍	❍	❍

Q8 A nutrient management program to manage for yield and agronomic sustainability is also relied upon to manage for environmental impact. Please answer the following questions to indicate why farmers in your county are interested in educational efforts relating to soil fertility management.

Q9 If regulation or cost-share did not provide an incentive, farmers in my county would be less likely to pursue soil tests and follow recommendations.

- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q10 Farmers who develop Nutrient Management Plans regularly update their plans every 4 years or less.

- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q11 Farmers follow their soil test recommendations for the most part.

- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q12 If there were no federal, state, or local requirements for Nutrient Management Planning, I would change how I taught soil fertility management.

- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q13 I have noticed an increase in testing for sulfur and/ or micronutrients in my county.

- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q14 The reason I believe farmers may not choose to follow the University recommendations is:

	Very Likely (1)	Likely (2)	Uncertain (3)	Unlikely (4)	Very Unlikely (5)
The farmers believe the recommendations are not accurate for their farm. (1)	❍	❍	❍	❍	❍
The farmers believe recommended rates are too costly. (2)	❍	❍	❍	❍	❍
The farmers have not received follow-up to help understand the recommended amounts to purchase and apply. (3)	❍	❍	❍	❍	❍
The farmers are satisfied to rely on what the fertilizer dealer or their agronomist recommends for the amounts to purchase and apply. (4)	❍	❍	❍	❍	❍

Q15 What are the farmer perceptions about soil testing as part of a crop management routine? Indicate how farmers in your county would likely respond to the following statements:

	Strongly Disagree (1)	Disagree (2)	Neither Agree nor Disagree (3)	Agree (4)	Strongly Agree (5)
"Soil Testing is important in achieving a positive yield outcome." (1)	❍	❍	❍	❍	❍
"Soil Testing is cost effective." (2)	❍	❍	❍	❍	❍
" I am not regulated or receiving cost-share dollars, so I do not need to routinely soil test." (3)	❍	❍	❍	❍	❍
" My fertilizer dealer or cooperative consultant knows what I need." (4)	❍	❍	❍	❍	❍
" I do not bother with routine soil tests since I do not know how to interpret the recommendations anyway." (5)	❍	❍	❍	❍	❍
"I know what my crops need. I do not need a soils laboratory analysis" (6)	❍	❍	❍	❍	❍

Q16 How do you measure success for the nutrient management education and outreach program in your county? Indicate your use of these possible indicators for your program.

	Seldom (1)	Sometimes (2)	Often (3)	Most Often (4)
Number of Nutrient Management Plans completed (1)	❍	❍	❍	❍
Public perception of decrease of nutrients in surface and/or ground water. (2)	❍	❍	❍	❍
Increase in economic yields of farm/field. (3)	❍	❍	❍	❍
Increase in yields of farms using soil testing, laboratory analysis and University recommendations (4)	❍	❍	❍	❍
Farmer satisfaction with service and outcome. (5)	❍	❍	❍	❍
I do not measure success for nutrient management education and outreach. (6)	❍	❍	❍	❍
Other (describe) (7)	❍	❍	❍	❍

Q18 The role of the UW Extension Agriculture and Natural Resources Educator is to educate, not regulate. Yet, we work closely with the regulators and the regulated. Please indicate your level of agreement or disagreement with the following statements in relation to soil nutrient management.

Q19 The UW-Extension should consider our education and outreach regarding soil testing and soil nutrient management recommendations to focus primarily on economic yield goals.
- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q20 Soil testing is an essential tool for agronomic input management.
- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q21 Farmers utilize soil tests and soil analysis recommendations to remain in compliance with their Nutrient Management Plans, and otherwise would sample, test and follow recommendations with less frequency and attentiveness.
- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q22 Farmers associate following soil test recommendations with managing water quality.
- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q23 Farmers believe there is significant economic benefit to soil tests beyond qualifying for programs/regulation.
- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q24 Farmers that follow a Nutrient Management Plan required for cost-share or regulation have a better grasp on economic yield goals and how to interpret a soil test recommendation than those that are not required to follow a Nutrient Management Plan.

- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree nor Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q25 Tell us about the farmers and the land they farm. Please answer the following questions to indicate your perceptions of the attributes of the farms and farmers in your county.

Q26 The percentage of farmland in my county that is used to raise the following:

	less than 10% (1)	10-30 % (2)	31%-50% (3)	greater than 51% (4)
Cash Grain (1)	❍	❍	❍	❍
Livestock (2)	❍	❍	❍	❍
Dairy (3)	❍	❍	❍	❍
Vegetable (4)	❍	❍	❍	❍
Other (5)	❍	❍	❍	❍

Q27 How many Confined Animal Feeding Operations are located in your county?

- ❍ 0-2 (1)
- ❍ 3-6 (2)
- ❍ 7-12 (3)
- ❍ >12 (4)

Q40 Most farmers maintain a regular soil testing rotation (Testing each field every 4 years)

- ❍ Never (1)
- ❍ Rarely (2)
- ❍ Sometimes (3)
- ❍ Often (4)
- ❍ Do Not Know (5)

Q41 The farmers that test their soils also follow the University recommendations.
- ❍ Never (1)
- ❍ Rarely (2)
- ❍ Sometimes (3)
- ❍ Often (4)
- ❍ Do Not Know (5)

Q42 How many Certified Crop Advisors are writing Nutrient Management Plans in your county?
- ❍ (1)
- ❍ 2-5 (2)
- ❍ 6-10 (3)
- ❍ >10 (4)

Q28 Farmers who send soil samples to a laboratory for nutrient analysis also send forage samples to a lab for nutrient analysis.
- ❍ Never (1)
- ❍ Rarely (2)
- ❍ Sometimes (3)
- ❍ Often (4)
- ❍ Do Not Know (5)

Q29 The conventional farmers in my county are more likely than certified organic farmers to test their soils using University of Wisconsin recommendations.
- ❍ Strongly Disagree (1)
- ❍ Disagree (2)
- ❍ Neither Agree or Disagree (3)
- ❍ Agree (4)
- ❍ Strongly Agree (5)

Q30 In addition to soil testing, farmers use the following tests: (choose two (2) that are most likely to apply in your county)
- ❍ Manure testing (1)
- ❍ Plant tissue testing (2)
- ❍ Forage testing (3)
- ❍ Disease diagnostic testing (4)

Q31 Farmers are most likely to send their samples to:
- ❍ The University of Wisconsin Soil Testing Laboratory (1)
- ❍ Private DATCP certified lab (2)
- ❍ Private non-DATCP certified lab (3)

Q32 What is your estimate of the percent of farmers participating in USDA-Farm Service Agency programs?

- ❍ 0-25% (1)
- ❍ 26-50% (2)
- ❍ 51-75% (3)
- ❍ >75% (4)

Q44 Of those farmers who do not participate in USDA –Farm Service Agency programs, what do you perceive is the percentage that regularly tests their soils?

- ❍ 0-25% (1)
- ❍ 26-50% (2)
- ❍ 51-75% (3)
- ❍ >75% (4)

Q33 Farmers that tend to utilize UW-Extension education and outreach support for their farming operations are most likely to be:

- ❍ Farmers trying to develop cash flow (1)
- ❍ Farmers trying to increase their positive cash flow. (2)
- ❍ Equally likely to be both (3)
- ❍ None of these choices (4)

Q34 Is there karst topography or shallow to bedrock geology (<2 feet) in your county?

- ❍ yes (1)
- ❍ no (2)

Q35 The predominate surface soil texture of the agricultural land in your county is:

- ❍ loamy sand (1)
- ❍ sandy loam (2)
- ❍ silt loam (3)
- ❍ clay loam (4)
- ❍ other (describe) (5) _____

Q36 Does your county have a water body on the EPA Impaired Waters (303 (d)) list?

- ❍ Yes (1)
- ❍ No (2)
- ❍ Do not know (3)

Q37 Please indicate your major field of study: (i.e.-Crops and Soils, Dairy Science, Agriculture Education, Plant Science, Agricultural Economics etc.)

Undergraduate (1)
Graduate (2)

Q38 In what Administrative Region of UW-Extension do you currently work?

- ❍ Southwest (1)
- ❍ East Metro (2)
- ❍ North Central (3)
- ❍ Northwest (4)

Q39 Thank you for participating in this survey.