

IMPROVING CONSERVATION AND AG ECONOMICS WITH WATER QUALITY CREDIT TRADING AND THE BMP CHALLENGESM

Final Report
5/6/2011

SUPPORTED BY USDA NRCS
CONSERVATION INNOVATION GRANT
NRCS #68-3A75-6-114

Grantee Name: Agflex, Inc.	
Project Title: Improving Ag and Conservation Economics with Water Quality Credit Trading and the BMP CHALLENGE	
Agreement Number: 68-3A75-6-114	
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Period Covered by Report: July 27 th 2006 – July 31 st 2010	
Project End Date: July 31 st 2010	

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I. Summary of Work Performed

Our project protected and enhanced water resource quality by refining and expanding the innovative BMP CHALLENGE net income guarantee, including in conjunction with water quality credit trading. The BMP CHALLENGE provides foregone income protection and technical assistance to corn producers who have not yet adopted Best Management Practices (BMPs). Farmers work with qualified crop advisors to implement nutrient management or conservation tillage on a demonstration field on their farms. The BMP CHALLENGE tool can be used to support adoption of both basic and advanced conservation practices.

To date, farmers participating in the BMP CHALLENGE on more than 150 farms and 14,000 acres in 12 states have eliminated 375,000 lbs. of nitrogen applications, and prevented losses of 3000 tons of sediment and 4000 lbs. of phosphorus. According to surveys of past participants, 94% were satisfied with their experience and have continued or plan to continue the BMP or a modified form after their experience.

Technical assistance for nutrient BMPs addresses product form, rate, timing and placement. For conservation tillage, assistance includes reduced tillage system selection, equipment set up and additional visits during the season to assess weed and irrigation management and adjust as needed. Crop advisors must be CCAs, state-certified or have equivalent experience to ensure competent implementation.

To estimate the impact of the BMP, crop advisors carefully place a control, or “check” strip within the field, following a written protocol, where participating farmers implement their conventional practice. A single check strip is used to reduce time, expense and management complications for producers. An in-depth analysis of this single check strip approach was completed (Mitchell 2002), reviewed by multiple independent experts and approved by the Federal Crop Insurance Corporation Board (USDA RMA 2003) prior to initiation of the project.

The crop advisor supervises harvest. Yields and input costs from immediately adjacent BMP and check strips are compared. Farmers are compensated for any net income loss, taking into consideration savings from the BMP. Agflex serves as a model for a new type of Technical Service Provider, identifying late-adopter farmers, providing both technical assistance and verified foregone income protection, and increasing adoption.

The BMP CHALLENGE is cost effective, reducing nitrogen losses at an average cost of \$1.87 per pound, comparable to or below the cost of alternative practices. The program is adaptable to both NRCS Environmental Quality Incentives Program and Agricultural Management Assistance. We successfully used the program to generate water quality trading credits in Pennsylvania, and helped prepare Minnesota agriculture for trading as new trading rules and Total Maximum Daily Loads (TMDLs) are put in place.

Collaborators included American Farmland Trust and Kieser & Associates. Four additional funders supported the program, as did participating farmers who contribute a portion of their earnings when net income improves as a result of the BMP.

II. Deliverables, Status, Challenges in Meeting Deliverables

Deliverables from the grant, as included in section IV of the agreement are as follows. Progress against deliverables is reported in Table 1.

1. Water quality credit trading and BMP CHALLENGE training curriculum including PowerPoint presentations, worksheets intended to fully inform state agency and conservation district staff, crop advisors and others about trading and guarantee opportunities for their farmer clients;
2. 24 full-day seminars with 75 participants each, attendance lists, agendas;
3. Compilation of trading and guarantee tools including fact sheets, forms and BMP CHALLENGE website to enable those working with farmers to enroll them in trading and guarantees;
4. Training plan, six trained individuals (three in PA, three in MN) to deliver seminars;
5. Inventory of potential point and non-point traders, trades, values, credits, rates, forms, implementation and verification procedures;
6. 150,000 brochures produced and distributed; 2-3000 farmer inquiries generated to state agencies, crop advisors, watershed groups;
7. 20 point-sources prepared to trade, list of trades completed, guarantees implemented, acres, practices, estimated resource improvements;
8. 12 quarterly and one final progress reports; three annual advisory meetings by conference call and three in person
9. Reductions of 760,000 lbs. of N use, 40,000 lbs. of P loading; 30,000 tons of sediment loading, 25,000 lbs. NO2 and 5000 tons CO2 greenhouse gases from nutrient management, conservation tillage, ditch management and other practices on approx. 34,000 acres in the Minnesota, Susquehanna and Potomac River Watersheds.

Table 1. Progress against deliverables

<p>1. WQ trading and BMP CHALLENGE curriculum delivered to MN state agency, conservation districts, crop advisors and others to equip them to offer these opportunities to their producer clientele.</p>	<p>a. Calendar of industry and extension meetings has been created and continually modified with contact information for meeting organizers.</p> <p>b. BMP CHALLENGE and WQCT meetings and conferences, 2,210 participants to date:</p> <ul style="list-style-type: none"> - July 19, 2010 St. Louis, MO 615 participants - June 10, 2010 Nebraska City, NE 54 participants - March 21, 2009, New Ulm, MN, 60 participants; - September 2008-March 2009, MN River Basin, MN, 40 participants; - March 5, 2009, Columbus, NE, 38 participants; - March 4, 2009, Wisner, NE, 48 participants; - February 23, 2009, New Lenox, IL, 38 participants; - February 18, 2009, Harrisburg, PA, 16 participants; - February 16, 2009, Harrisburg PA, 10 participants; - February 11, 2009, Saint Louis, MO, 48 participants;
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	<ul style="list-style-type: none"> -January 2009, Albuquerque, NM, 40 participants; -December 9, 2008, Duluth, MN, 30 participants; -December 8, 2008, St. Paul, MN, 98 participants; - August 5, 2008, Saint Cloud, MN, 23 participants; - July 29, 2008, Tucson, AZ, 50 participants; -April 16, 2008, Redwing MN, 148 participants; - April 1, 2008, Sauk Center, MN, 15 participants; -March 31, 2008, Faribault, MN, 28 participants; -March 28, 2008, Emmetsburg, IA, 48 participants; -March 24, 2008, Fairmont, MN, 30 participants -March 14, 2008, Marion, IA, 40 participants; -March 3, 2008, Napoleon, OH, 23 participants; -February 27, 2008, St. Paul, MN, 78 participants; -January 14, 2008, Sidney, OH, 60 participants; -January 10, 2008, Redwood Falls, MN, 35 participants; -January 7, 2008, Cannon Falls, MN, 28 participants; -December 18, 2007, Alexandria, MN, 26 participants; -November 26, 2007, Owatonna, MN, 16 participants; - August 30, 2007, New Haven, IN, 30 participants; -August 17, 2007, Huron County, OH, 48 participants; -August 10, 2007, Crawford County, OH, 48 participants; -July 27, 2007, Toledo, OH, 28 participants; -March 29, 2007, Shelbyville, MI, 7 participants; -January 11, 2007, New Ulm, MN, 42 participants; -2007, Rochester, MN, 38 participants; -December 7, 2006, Harrisburg, PA, 18 participants; -December 2006, Madison WI, 50 participants; -September 27, 2006, Lancaster County, PA, 28 participants; -September 15, 2006, Stark County, OH, 20 participants; -September 11, 2006, Cross Plains WI, 50 participants; -August 24, 2006, Champaign County, OH, 20 participants <p>c. Tom Green, Brian Brandt and Maggie Westaby updated the BMP CHALLENGE brochure and composed a cover letter directed towards agricultural professionals. Brochures were circulated to 10,499 contacts between December 2008 and January 2009.</p>
<p>2. Support package of existing tools for trainers, subset to be used as handout for seminars and available online.</p>	<p>a. Trainer curriculum and support materials package currently includes 2010 BMP CHALLENGE enrollment and implementation forms, presentation PowerPoint files and print-outs, curriculum outline with notes, water quality trading references, BMP CHALLENGE FAQ sheets and additional BMP information (i.e. alternative credit generating BMPs and management information). These materials were reviewed at a MN Trainer meeting in November 2007.</p> <p>b. Website updated regularly, with current documents and information. Recent updates include the addition of a webpage dedicated to the California BMP CHALLENGE and the addition of the 2010 forms for the Nutrient, Reduced Tillage and the California Reduced Tillage CHALLENGE.</p>
<p>3. Preparing three MN public agency/NGO trainers to train others on BMP CHALLENGE and WQ credit trading.</p>	<p>a. Three trainers have been trained for Minnesota:</p> <ul style="list-style-type: none"> - Shannon Fisher, MN River Board and Water Resources Center - Ed Hohenstein, Seven Mile Creek Watershed Project - Russ Derickson, MN Dept of Agriculture

	<p>In addition to these three, a number of other collaborators including several professionals on our advisory committee are gaining competency in addressing water quality trading and the BMP CHALLENGE with others.</p>
<p>4. Inventory of potential point and non-point source traders, trades, values, credits, rates, forms, implementation and verification procedures.</p>	<p>The draft MN State rules for water quality trading are now available, promulgation of official rules have been delayed.</p>
<p>5. 95,000 brochures, 1,000-1,500 farmer inquiries generated to state agencies, crop advisors, watershed groups on BMP CHALLENGE and WQ credit trading. Approximately 50 inquiries have been made from agricultural professionals since the Dec 08/Jan 09 mailing.</p>	<ul style="list-style-type: none"> a. 67,000 BMP CHALLENGE brochures were printed with approx. 66,000 distributed to date. b. Mailing of 1100 brochures to 14 agricultural professionals regarding their request to promote the BMP CHALLENGE since recruitment mailing of February 2010. c. Mailing of 150 brochures to Chippewa Valley Technical College in Eau Claire, WI regarding their request to use the brochure as part of their curriculum in a Land Management Course starting fall of 2009. d. Per the 2008 Outreach plan, a brochure and an electronic newsletter schedule with designated dates of dispersal and topic outlines has been developed. Potential future E-newsletter topics include: Update on the Farm Bill, EPA Non-point Source Outreach Toolbox, implications of the EPA CO₂ regulation mandate for the BMP CHALLENGE, a highlight on a main contact for a particular region, fall applications/tillage info, and updates on upcoming workshops, enrollment procedures, etc. e. Electronic newsletter mailing: March E-news, April 15, 2008 to 5240 contacts; Iowa BMP CHALLENGE workshop, February 28, 2008 to 1702 contacts; Redwood Falls Workshop Announcement, January 3, 2008 to 814 contacts; BMP CHALLENGE- Owatonna Workshop, November 13, 2007 to 975 contacts; MN BMP CHALLENGE/WQT Workshops-Owatonna, October 10, 2007 to 817 contacts; Owatonna Workshop "Save the Date" September 26, 2007 to 820 contacts; BMP CHALLENGE July 27, 2007, August 7, 2007 to 2451 contacts and August 27, 2007 to an additional 1670 contacts; April BMP CHALLENGE Update, April 20, 2007 to 2438 contacts; November BMP CHALLENGE Update, November 15, 2006 to 943 contacts; August BMP Performance Guarantee Update, August 8, 2006 to 832 contacts; Resend of August BMP Performance Guarantee Update, August 9, 2006 to 11 contacts; BMP Performance Guarantee Update, November 29, 2005 to 340 contacts.
<p>6. Ten point sources in MN prepared to trade, list of trades completed, acres, practices, credits, estimated resource improvements.</p>	<ul style="list-style-type: none"> a. Keiser & Associates have contacted and identified ethanol plants in the MN River watershed, which are currently willing to use the point-point trading permit system, but are not at this time committed to using the more desirable point-nonpoint trading system. One identified gap from these contacts is the lack of time necessary for managers of facilities to undertake trading. A method to facilitate trading for individuals with limited time resources to complete the buyer and seller connections and the bureaucratic permit

	<p>complexities is desired.</p> <p>b. The new 2008 CIG was funded to work with several watersheds to implement trades in the Sauk River watershed and throughout the Minnesota River Basin when the Lake Pepin and Sauk River Chain of Lakes TMDLs are issued. Establishment of protocols and estimation tools for six eight digit HUC watersheds is underway and awaiting TMDL approvals delayed until 2010-2011</p> <p>c. James Klang PE, and Brian Brandt have released a white-paper to help clarify how point and non-point perspectives view trading by interviewing potential buyers and sellers. The white paper was released in May 2008.</p> <p>d. Educational efforts have initiated conversations with numerous water quality trading participants. The project provided representation on the Citizens Advisory Committee for the MPCA draft of the Water Quality Trading Rules. .</p>
<p>7. Inventory of BMP CHALLENGE guarantees implemented, acres, practices, improvements.</p>	<p>a. Nutrient BMP guarantees have been implemented on approximately 100 farmer fields, resulting in an average 22.5% reduction in nitrogen fertilizer use.</p> <p>b. Reduced tillage was implemented in 2006 and since then 39 fields have been enrolled.</p> <p>c. With the goal of expanding the Planned Nitrogen Reduction option, which, refers to an additional 15% reduction in BMP rates for nitrogen fertilizer use. In 2008, 960 acres were enrolled and approximately 2500 acres in 2009.</p> <p>d. All results are recorded in a database.</p> <p>e. From 2000-2008, 4517.94 acres, 1700.50 acres and 4659.95 acres were enrolled in the Nutrient BMP, Reduced Tillage BMP and Planned Nitrogen Reduction BMP respectively.</p>
<p>8. Reductions of 760K lbs of N use, 40K lbs. P loading; 30K tons sediment loading; 25 K lbs. NO₂; 5K tons CO₂ from nutrient and tillage reduction on approximately 34K acres in MN and PA.</p>	<p>a. See tracking, below.</p>
<p>9. Funding development including \$759,464 in non-federal funding, \$170,500 in program income and \$944,400 in-kind. A portion of the non-federal funding and program income were applied to our matching funds requirement for the CIG grant.</p>	<p>a. Funding obtained during performance period, total \$1,998,000:</p> <ul style="list-style-type: none"> - 2006 Conservation Innovation Grant to Agflex, NRCS, \$683,000 - 2007 Bush Foundation Grant to AFT, \$75,000 - 2007 Pennsylvania Dept. of Environmental Protection (to IPM Institute, \$225,000 - 2007 Pennsylvania State Conservation Commission to IPM Institute, \$20,000 - 2007 Chesapeake Bay Commission to IPM Institute, \$25,000

	<ul style="list-style-type: none"> - 2008 Pennsylvania Dept. of Environmental Protection to IPM Institute, \$50,000 - 2008 Bush Foundation Grant to AFT, \$270,000 - 2008 Conservation Innovation Grant to AFT, \$650,000 - 2008 Conservation Innovation Grant to Minnesota River Board, \$999,993.60. - 2009 Conservation Innovation Grant to Agflex, \$930,703
10. Quarterly and final progress reports including conference call and advisory meeting minutes.	<ul style="list-style-type: none"> a. Advisory conference calls and meetings scheduled for Dec, Jan and Mar through Aug 2009, including one in-person meeting per year. b. BMP CHALLENGE Project team (Brandt, Green, Anderson, and contractors) meets at least twice monthly by conference call to manage BMP CHALLENGE acreage recruitment and implementation. c. MN BMP CHALLENGE and WQ Credit Trading team (Fisher, Green, Kieser & Associates, and Anderson) meets monthly by conference call, second Thursday of each month at 8:30am CST. Advisors welcome to participate. Call agenda and post-call notes circulated to project team and advisors.
11. Other	<ul style="list-style-type: none"> a. California expansion is in progress. Eligibility has been officially approved. Enrollment for 2010 was 16 farmers with over 1400 acres.

Challenges Achieving Deliverables

Although the BMP CHALLENGE has met the majority of deliverables proposed, several key factors influenced the achievement of the remaining goals. Key reasons for variance from proposed deliverables:

1. Proposed work in Pennsylvania was not fully funded, reducing activities and acres in that state. Additional matching funds anticipated but not received from the Pennsylvania Department of Environmental Protection for trading-related activities in that state were made up from other sources.
2. Continued delays in promulgation of trading rules in Minnesota have delayed related objectives in Minnesota.
3. Increase in corn prices from \$2.20 per bushel in 2006 to \$4.75 in 2008 and \$4.00 in 2009 resulted in higher costs per acre, reducing total number of acres accordingly.
4. Insufficient funds were allocated in the original budget to support trainers, making retention difficult. On the plus side, we ended up training more individuals than planned.

III. BMP CHALLENGE Results Summary

A. Overall Summary Results: Nutrient, Reduced Tillage, Planned Nitrogen Reduction

Between 2000 and 2009, the BMP CHALLENGE and predecessor pilots had participating farmers in 12 states including CA, IA, IL, IN, MD, MN, MO, NE, OH, PA, VA and WI. Since 2000, pilots, the BMP CHALLENGE and Planned N Reduction programs have been implemented on nearly 14,000 acres (Table 2).

The BMP CHALLENGE supports adoption of nutrient management and conservation tillage in corn grown for grain or silage. Planned N Reduction uses the BMP CHALLENGE model to generate additional nitrogen loss reductions by applying nitrogen below BMP rates in watersheds with nitrogen-impaired waters.

Participating farmers have reduced nitrogen applications by 377,563 lbs, resulting in a reduction of 7119 lbs. of NO₂, a potent greenhouse gas. Reductions of 3078 tons of sediment and 4103 lbs. of phosphorus have been achieved by farmers participating in the Reduced Tillage BMP CHALLENGE program.

On average, farmers have experienced negative net returns (value of yield difference plus input cost savings) by implementing nutrient management or reducing tillage. Reduced tillage can result in a yield drag in colder climates, in seasons with cold, wet springs, or in the initial years when the farmer is working through the learning curve and soil structure is in transition. We also anticipated reduced yields with Planned N Reduction.

We did not anticipate the yield reductions observed from nutrient management and hypothesize these reductions may have resulted from older BMPs in need of updating. Most plans used a static lbs. of N per bushel of expected yield established many years ago, e.g., 1.2 lbs. per expected bushel, and are likely no longer accurate given higher yield potentials of current varieties. Most nutrient management plans, while typical of those in use by most producers, did not include advanced practices such as split applications or controlled release formulations. In addition, growing conditions for corn during our project years were better than average, resulting in higher than average yields and potentially insufficient N to maximize yields in these years. Finally, higher corn prices result in a higher return to N, also not reflected in older nutrient BMPs.

Table 2. Summary results for the BMP CHALLENGE and Planned Nitrogen Reduction Programs through 2009.

2000-2009 RESULTS	Nutrient BMP CHALLENGE®	Reduced Tillage BMP CHALLENGE®	Planned Nitrogen Reduction	Totals
Total acres, 2000-2009	4837 acres	2051 acres	7072 acres	13,960 acres
BMP yield, average and range	160.3 bu/acre 59 - 220	156.1 bu/acre 32- 237	153.5 bu/acre 55-229	
Check-strip yield, average and range	166.9 bu/acre 49-230	165.9 bu/acre 26- 242	163.9 bu/acre 63-238	
Average farmer net returns after fertilizer or tillage savings	(\$4.81) (\$89) - \$109	(\$13.49) (\$156) - \$130	(\$33.75) (\$284) - \$105	
Total N use reduction	184,935 lbs	-	190,351 lbs	375,286 lbs
Estimated sediment reduction	-	3078 tons	-	
Estimated P load reduction	-	4104 lbs	-	
Estimated N ₂ O reduction	3530 lbs	-	3589 lbs	7119 lbs
Estimated CO ₂ reduction		1026 lbs		

B. Nutrient BMP CHALLENGE® Results

Corn for Grain or Silage, 2000-2009

By following land-grant-university (LGU) recommended Best Management Practices for nitrogen (N) management vs. each farmer's traditional practice, BMP CHALLENGE participants reduced N use by 38.2 lbs. per acre on 100 fields, for a total of nearly 184,935 lbs. N-use savings (Table 3). Using an estimate of 29% average efficiency, these use reductions translate to loss reductions to surface water of almost 54,000 lbs. at an overall cost of \$1.87 per lb. including costs of technical assistance, administration and payments to farmers who experience negative net returns.

Calculated efficiencies (reductions in loss/reduction in amount applied) vary widely depending on soil type, slope, amount of excess fertilizer applied, tillage system and other factors. Efficiencies calculated for N management have ranged from 15% to 58% (Hall and RIsser 1993, Hamlet and Epp 1994, VanDyke 1997), including estimates that fertilizer applied in excess of agronomic rates increase losses by a factor of three vs. applications at or below agronomic rates (Parsons *et al.* 1995).

N fertilizer reductions also contributed to reduced emissions of N₂O, a potent greenhouse gas, by nearly 3530 lbs. Production of N fertilizer results in CO₂ emissions; by avoiding these applications, CO₂ emissions were reduced by 516 tons.

A total of 4837 acres was enrolled, or an average of 48.4 acres per field. Participating producers were located in eight states: IA, IL, IN, MN, NE, OH and WI. Qualified crop advisors prepared nutrient management plans for each field following recommendations from the LGU for the location. Crop advisors also followed a written protocol to carefully position a check strip in each field. The farmer applied his or her traditional N management practice on the check strip. Advisors returned at harvest to supervised yield comparisons between the check strip and the immediately adjacent strips using a yield monitor, weigh wagon, or portable or stationary scales.

A single set of comparison strips was used to reduce time, expense and management complications for producers and crop advisors. An in-depth analysis of this single check strip approach was completed and reviewed by four independent experts and approved by the Federal Crop Insurance Corporation Board in 2003 (USDA RMA 2003). The analysis concluded that yield on immediately adjacent strips is highly correlated at 90% or higher. In other words, nine times out of ten, one can expect the yields to be within 5% on immediately adjacent strips placed at random within the field. Our written strip placement protocol is designed to improve upon that correlation by directing the crop advisor to locate the strips in a uniform, representative area of the field.

Nutrient management plans included a variety of basic BMPs including crediting N from preceding legume crops and any manure applications, typical of most nutrient management plans. Some producers also split applications to increase the amount of N applied closer to crop need or soil testing for nitrate N after crop emergence ("late spring" or "pre-sidedress" nitrate test). No nutrient management plans were based on new N recommendation systems such as the Iowa N-rate calculator, which estimates an

optimum range of N rates based on N fertilizer cost and expected corn selling price, and which have not yet been widely adopted.

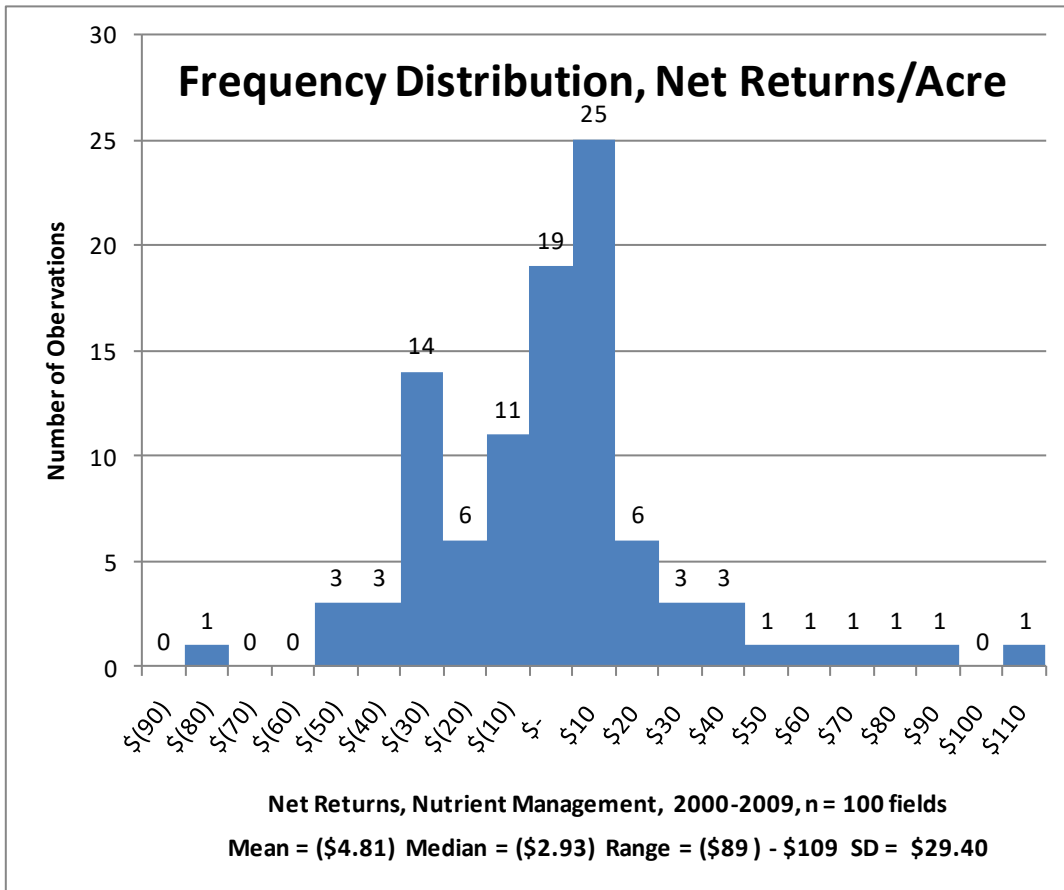
Corn and N fertilizer prices varied considerably over the decade, ranging from \$0.23 to \$0.74 per lb. of N, and from \$2.20 to \$4.75 per bushel. Overall averages were \$0.43 per lb. for N and \$3.36 per bu. for corn.

Table 3. Nutrient BMP CHALLENGE participation by year; nitrogen (N) and corn prices; N, N loss, nitrous oxide (N₂O), carbon dioxide (CO₂) reductions, average net returns, farmer payments and cost of N loss reduction, 2000 through 2009.

Year	No. fields	Total acres	Avg. price N (\$/lb.)	Avg. price corn (\$/bu.)	Total reduction in N applied (lbs.)	Average reduction in N applied per field (lbs./acre)	Estimated total N loss reduction at 29% efficiency (lbs.)	Total N ₂ O reduction (lbs.)	Total CO ₂ reduction (tons)	Average yield difference, check strip vs. BMP strip	Average net economic returns per field (\$/acre)	Average payout to farmer (\$/acre)	Avg. cost N loss reduction (\$/lb)
2000-05	31	1370.9	\$ 0.23	\$ 2.35	52,909.5	39.3	15,343.8	997.7	147.7	-5.2	\$ (2.62)	\$ 6.02	\$ 1.02
2006	32	1406.0	\$ 0.33	\$ 2.20	54,841.0	43.2	15,903.9	1034.1	153.1	-6.4	\$ 0.79	\$ 11.89	\$ 1.71
2007	19	805.1	\$ 0.41	\$ 3.50	37,962.3	46.9	11,009.1	715.9	105.9	-8.9	\$ (10.64)	\$ 16.29	\$ 1.85
2008	14	935.9	\$ 0.43	\$ 4.75	28,890.0	36.2	8378.1	544.8	80.6	-10.6	\$ (25.64)	\$ 22.76	\$ 3.80
2009	4	319.0	\$ 0.74	\$ 4.00	10,332.6	48.8	2996.5	194.8	28.8	6.3	\$ 34.03	\$ 3.83	\$ 0.90
Avg./yr.	20	967.4	\$ 0.43	\$ 3.36	36,987.1	42.9	10,726.3	697.5	103.2	-5.0	\$ (0.82)	\$ 12.16	\$ 1.85
Avg./ac.	-	-	\$ 0.36	\$ 3.07	-	41.9	11.1	0.9	0.1	-6.6	\$ (4.81)	\$ 12.93	\$ 1.87
Total	100	4836.9	-	-	184,935.4	-	53,631.3	4184.8	516.1	-	-	\$62,527.45	\$ 100,132.11

Participants achieved an average yield of 159.9 bushels on the BMP portion of the field vs. 166.49 bushels on the check strip. Farmer net economic returns averaged over the 100 fields were a negative \$4.81 per acre, reflecting an average fertilizer savings of approximately \$15 against an average yield value reduction of about \$20. Economic returns were calculated by adding fertilizer cost reductions to the difference in value of the yield produced on the check strip vs. the immediately adjacent BMP strips. In other words, on average, fertilizer savings failed to make up for the yield deficit on the BMP portion of the field.

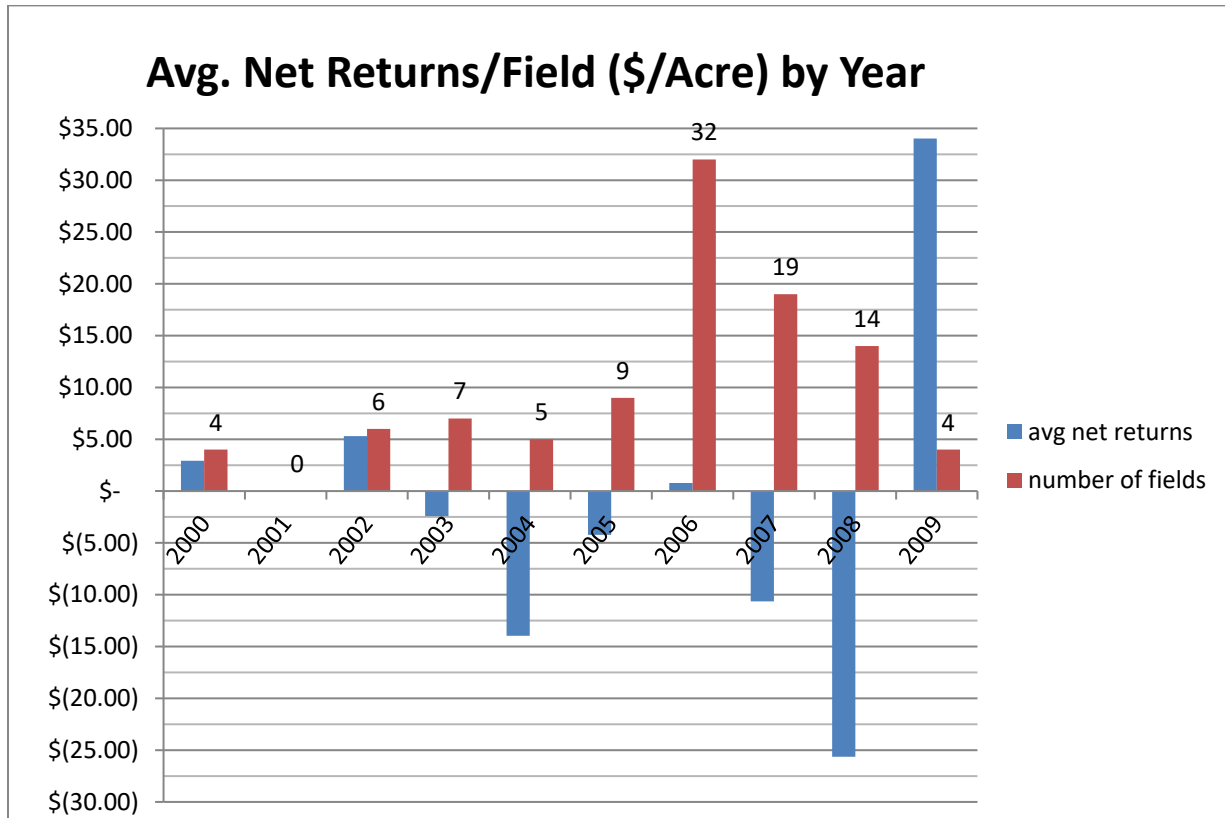
Figure 1. Frequency distribution of per acre net returns for 100 fields enrolled in the Nutrient BMP CHALLENGE through 2009.



Net returns ranged from a low of negative \$89 per acre to a high of \$109 per acre (Figure 1). Forty-four fields had net returns within \$10 of break even, with 19 of those fields at break even or less. A total of forty-three fields experienced positive net returns. Thirty-eight fields experienced net losses greater than \$10 per acre. Farmers were compensated for negative net returns. Fifty-seven farmers received compensation averaging \$12.93 per acre or \$1008 per field, for a total of \$62,527 in compensation.

Net returns varied considerably by year (Figure 2), with a high of \$34 average net return in 2009 with four participating fields and a low of (\$25) average net return in 2008 with 14 fields enrolled.

Figure 2. Yearly average net returns per field in dollars per acre, and number of fields enrolled each year.



Negative net returns may result from a number of conditions. These include:

1. Nearly all of the nutrient management plans for participating fields used a static N rate, e.g., 1.2 lbs. of N per bu. expected yield. This BMP does not take into account the increasing economic return for N applications as corn prices increase. N-rate recommendations from several cornbelt LGUs now include a maximum-return-to-N approach, incorporating both corn price and N cost. (For example, see <http://extension.agron.iastate.edu/soilfertility/nrate.aspx>.) Most plans, while representative of typical plans used by corn producers who have plans, also did not include all possible opportunities to improve N-use efficiency such as split applications, controlled release formulations, etc.
2. The static rate of N per bu. expected yield has not changed in many years, and may not be adequate for newer varieties that are higher yielding, or that may require more N (e.g., varieties with plant-incorporated pesticides for corn rootworm).
3. University-developed BMPs are not designed to maximize yield but to optimize net income over time. Corn yields have been generally higher than average in recent years, with average yield per acre in the US higher than the 2000-2009 average in every year from 2004 to 2009. We are overdue for a year when moisture, heat or sunlight conditions limit production and reduce returns to N.

4. Higher-than-average rainfall amounts and intensity between the time of N application and crop need may result in higher-than-expected N losses and reduced yields. We experienced unusually heavy rainfall in a number of cases which may have contributed to the negative net return observed here.

The large number of variables encountered during the course of this project, including geography, weather conditions, varieties, BMPs, tillage practices, etc., precludes a definitive determination of the cause of the negative net return observed here.

We calculated an average \$1.88 cost per lb. of N loss reduced by multiplying our total N use reductions by an estimated efficiency of 29%. We then divided our total N loss estimate by the cost of the program including crop advisor payments of \$3.25 per acre for check strip layout and harvest supervision, farmer payouts per acre, plus estimated administrative costs of 30% of payouts, plus a contribution to reserves of 5%.

Administrative costs include processing farmer and crop advisor enrollment, collection of nutrient management plan, fertilizer cost, check strip and yield data, processing payments to farmers and crop advisors, and maintaining forms for enrollment and participant data collection. They do not include outreach to and recruitment of conservationist, crop advisor and farmers, program development, data analysis, or grant management including financial and other performance reporting.

According to our 2011 survey results, 94% of participating farmers intend to continue to modify their traditional practices after participation. Assuming average total corn production of 190 acres per farm, reductions achieved here translate into annual reductions of 469,699 lbs. of N use and 136,213 lbs. of N loss reduction on participating farms post-BMP CHALLENGE.

Recent Conservation Effects Assessment Program reports suggest that 15% to 20% of US cropland lacks basic nutrient management practices. If N-loss reductions achieved here were made on 15% to 20% of the 88 million corn acres grown in 2010, we would have achieved N loss reductions of 158 million to 207 million lbs. at a total cost of \$85 million to \$112 million. Presumably these initial costs could be reduced by 75% by enrolling just 25% of acres managed by farmers not currently using basic nutrient BMPs. Assuming 59% of these producers continue to follow the BMP and expand the practice to all of their corn acres, we could achieve these N-loss reductions each year for the nominal cost of updating nutrient management plans for each field.

C. Planned N Reduction Results

The Planned N Reduction program uses BMP CHALLENGE mechanics but participants reduce their N application rates further. These producers used a variety of BMPs including split applications, pre-sidedress N tests and corn-stalk N tests, but reduced the total N applied below the amount calculated by the crop consultant as consistent with LGU recommendations.

This pilot was developed in response to broad interest (Chesapeake Bay Commission 2004, Clancy *et al.* 2001, Metcalfe *et al.* 2007) in examining the impact of this practice on yields and net returns, to determine overall costs vs. benefits as a tool for improving water quality in N-impaired watersheds.

Funding was provided primarily by the Pennsylvania Department of Environmental Protection Growing Greener Program with additional funding from the Pennsylvania Department of Agriculture, the Pennsylvania Conservation Commission, the Chesapeake Bay Foundation, the Chesapeake Bay Commission Pennsylvania Delegation, USDA Natural Resource Conservation Service, National Fish and Wildlife Foundation, Cora Brooks Foundation, the Curtis & Edith Munson Foundation and George & Miriam Martin Foundation.

Through 2009, a total of 74 fields were enrolled (Table 4). Sixty-five fields received nitrogen application rates between 14 and 18% below BMP rates, with an additional 9 fields receiving other reductions from as low as 27% to as high as 9% below BMP rate (Figure 3).

Average net returns were negative \$34.27 per acre (compared to negative \$4.81 for the Nutrient BMP CHALLENGE), resulting in an average cost of \$12.58 per lb. of N reduced. Only seven fields (9.5%) experienced a positive net return (Figure 3). The average acre lost 12 bushels vs. the check strip, vs. 6.6 bushels for the Nutrient BMP CHALLENGE.

We calculated the average \$12.58 cost per lb. of N loss reduced by multiplying our total N use reductions by an estimated efficiency of 29%. We then divided our total N loss estimate by the cost of the program including crop advisor payments of \$1500 per farmer (for farmer recruitment, reduction calculation, check strip layout and harvest supervision), farmer payouts per acre, a \$30 per acre additional farmer incentive, plus estimated administrative costs of 30% of payouts and 5% contribution to reserves.

In Pennsylvania in 2009, 945 “nutrient credits” were generated from several fields enrolled in this pilot and contributed to the Lancaster Farmland Trust, Lancaster County, PA (American Farmland Trust 2010). These credits represent a portion of the nitrogen losses to surface water in the Chesapeake Bay Watershed and were calculated using a template created by Kieser & Associates and a calculator developed by the Pennsylvania Department of Environmental Protection and modified slightly for use in this project (Appendix D).

We estimate that costs could be reduced further to \$9.63 per lb. by reducing crop consultant payments to \$1200 per farmer and reducing farmer incentives to \$15 per acre. Finally, additional cost reductions can be achieved by targeting those acres most at risk of nitrogen losses due to site-specific characteristics and location within the watershed. These additional cost reductions may be offset by more conservative efficiencies in specific fields, e.g., nutrient credit generation in Pennsylvania used efficiencies of 15% and 17.7% for fields using reduced tillage or no till, respectively, vs. the 29% we used here.

A comprehensive study examining the feasibility of the Planned N Reduction is due to be presented to funders including NRCS in May 2011.

Table 4. Planned N Reduction pilot participation by year; nitrogen (N) and corn prices; N, N loss, nitrous oxide (N₂O), carbon dioxide (CO₂) reductions, average net returns, farmer payments and cost of N loss reduction, 2005 through 2009.

Year	No. fields	Total acres	Avg. price N (\$/lb)	Avg. price corn (\$/bu)	Total reduction in N applied (lbs)	Average reduction N applied per field (lbs/acre)	Estimated total N loss reduction at 29% efficiency (lbs)	Total N ₂ O reduction (lbs)	Total CO ₂ reduction (tons)	Average yield difference, BMP strip vs. check strip (bu)	Average net economic returns per field (\$/acre)	Average payout to farmer (\$/acre)	Avg. cost/lb N loss reduction
2005	2	68.0	\$ 0.23	\$ 2.35	1020.00	15.00	295.80	19.23	2.85	8.89	\$ 24.05	\$ 30.67	\$ 26.56
2006	18	1687.6	\$ 0.33	\$ 2.20	45720.80	26.44	13259.03	862.16	127.60	-15.15	\$ (28.45)	\$ 32.58	\$ 11.45
2007	19	1944.4	\$ 0.45	\$ 3.50	52738.70	27.68	15294.22	994.50	147.19	-7.83	\$ (18.18)	\$ 36.60	\$ 11.96
2008	10	960.0	\$ 0.63	\$ 4.75	24760.00	25.60	7180.40	466.90	69.10	-9.20	\$ (31.29)	\$ 29.59	\$ 11.44
2009	25	2412.0	\$ 0.74	\$ 4.00	66234.45	27.56	19207.99	1248.99	184.85	-15.32	\$ (56.55)	\$ 49.24	\$ 14.07
Avg./yr.	14.8	1414.4	0.476	3.36	38094.79	24.46	11047.49	718.36	106.32	-7.72	\$ (22.08)	\$ 35.74	\$ 15.10
Avg./acre	-	-	\$ 0.54	\$ 3.52	-	27.28	7.81	0.51	0.08	-11.87	\$ (34.27)	\$ 38.94	\$ 12.58
Total	74	7072.0	-	-	190,473.95	-	55237.44	3,591.79	531.59	-	-	\$ 275,408.49	\$ 598,566.99

Figure 3. Frequency of N reductions from BMP rates by percent for Planned N Reduction.

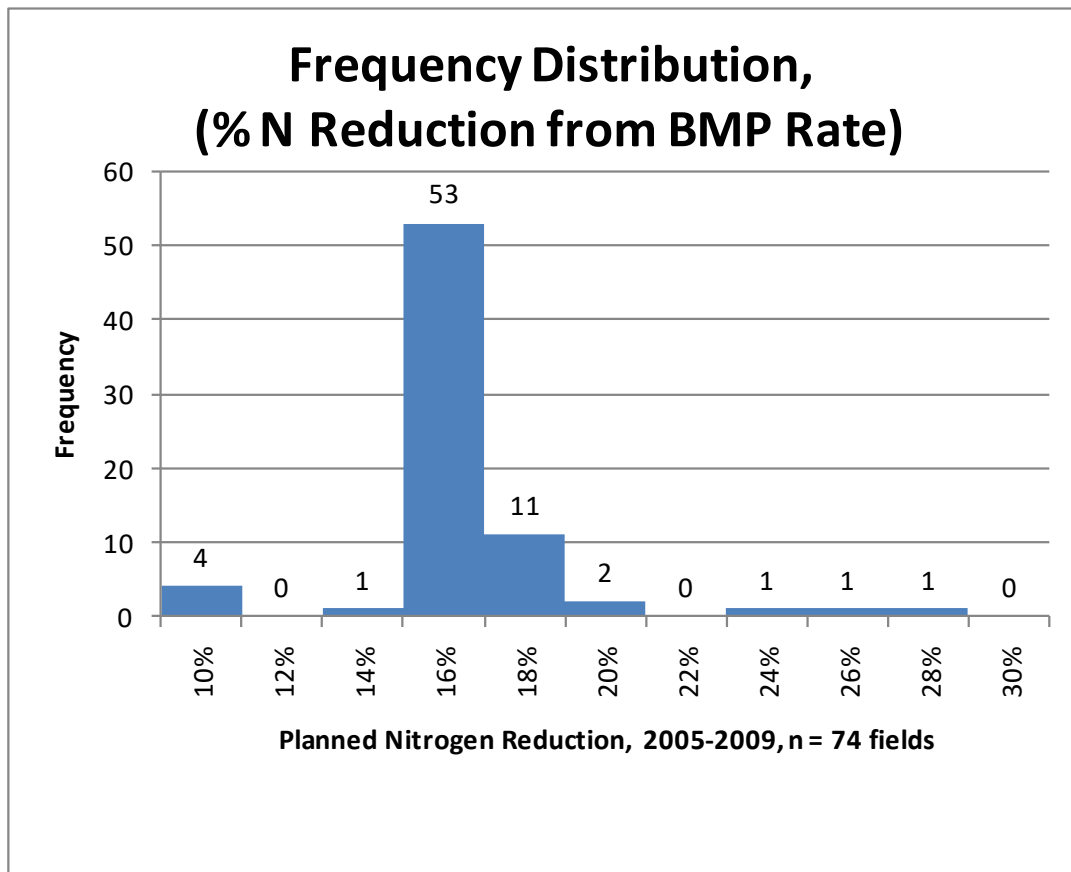
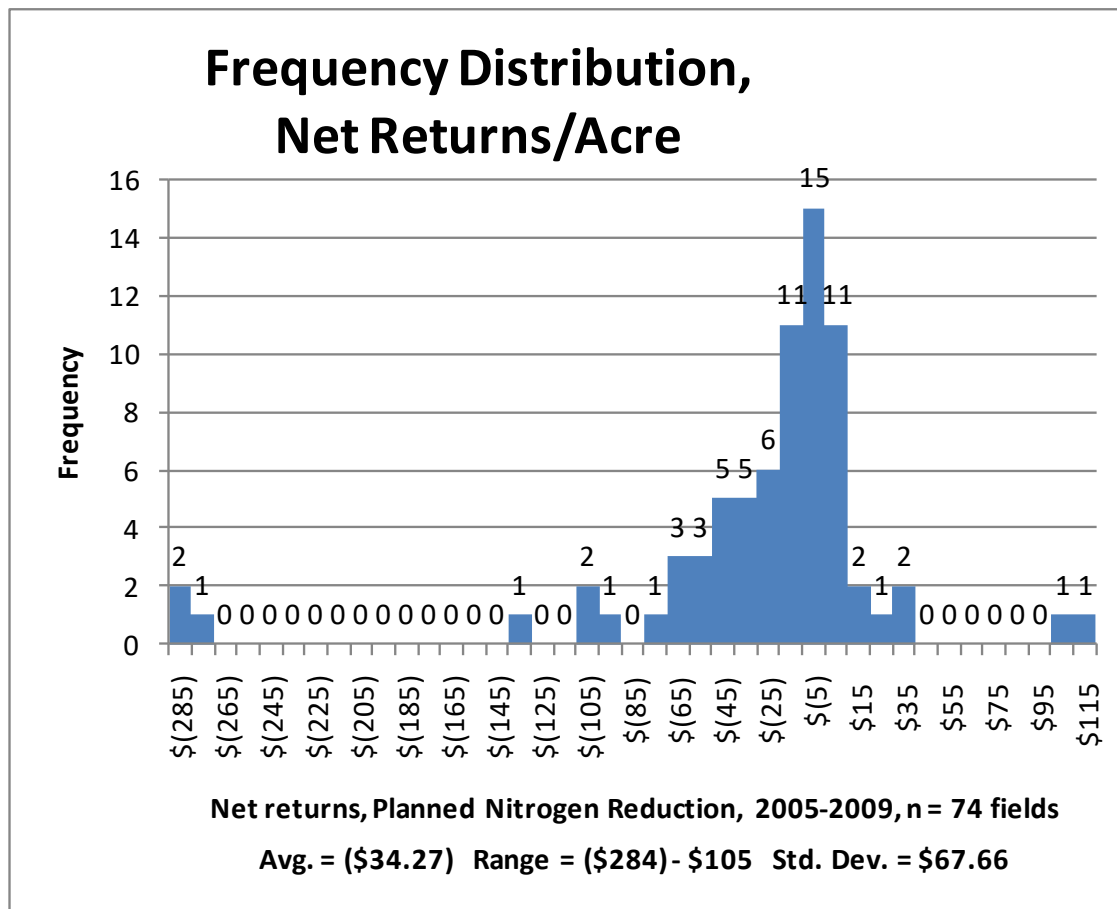


Figure 4. Frequency distribution of per acre net returns for 100 fields enrolled in Planned N Reduction through 2009.



D. Reduced Tillage BMP CHALLENGE® Results

Thirty-nine fields for a total of 2052 acres were enrolled in the BMP CHALLENGE for conservation tillage from 2006 through 2009 (Table 5). A variety of tillage systems were used, primarily no till but also a limited number of strip and ridge till fields.

We used flat rate formulae to estimate sediment reduction (1.5 tons per acre), P loss reduction (2 lbs. per acre) and CO₂ reduction (0.5 lbs. per acre). Tillage cost reductions were calculated primarily from the Purdue WinMAX program, although some participants used estimates provided by their crop consultants from local LGU recommendations.

Program costs included farmer payouts, \$6 per acre crop consultant fee for check strip set up, harvest assessment and technical assistance for tillage equipment set up and

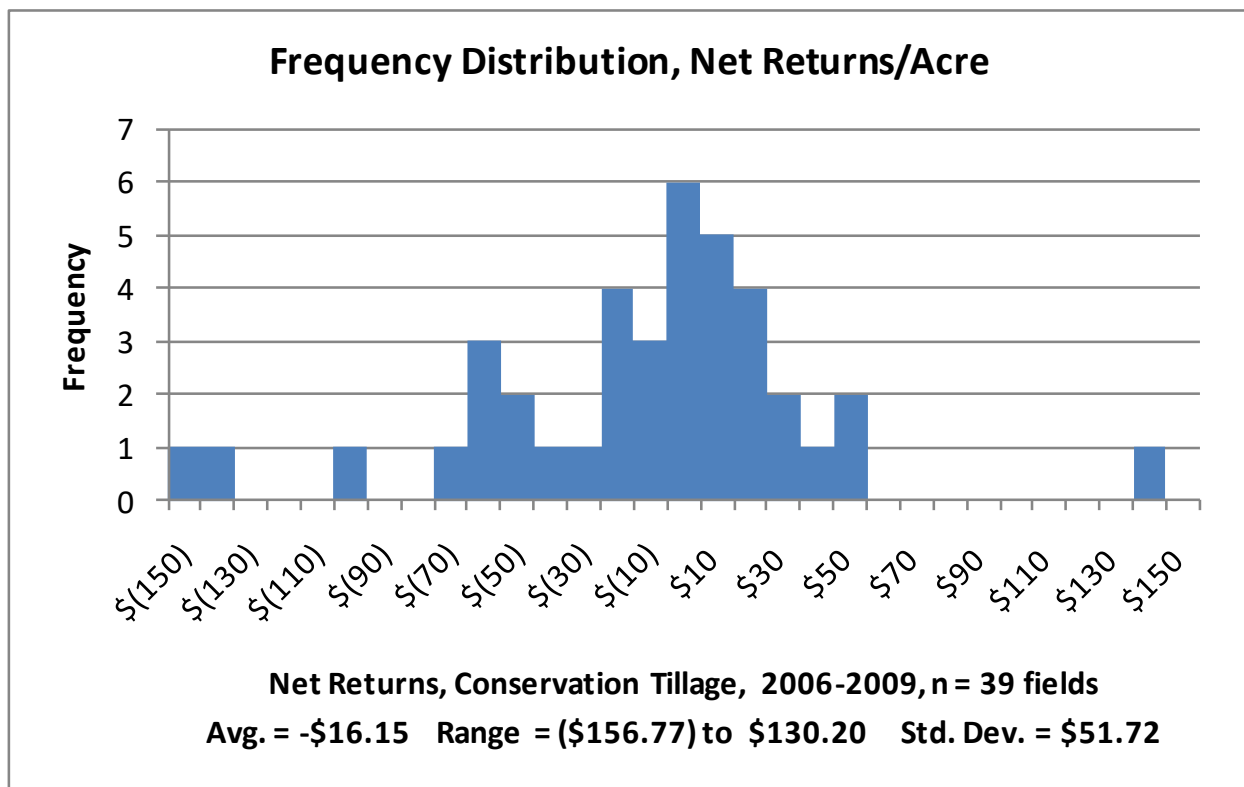
two visits during the season to evaluate progress and recommend adjustments if needed, plus 30% administration and 5% contribution to reserves.

On average, participants experienced a 9.7 bu. loss and net returns of negative \$16.15 per acre after factoring in an average tillage cost savings of \$10.89 per acre. Net returns ranged from a high of \$130 to a low of negative \$157.

Table 5. Reduced Tillage BMP CHALLENGE participation by year, sediment, P, CO₂ reduction, tillage cost reduction, net economic returns and program costs, 2006-2009.

Year	No. fields	Total acres	Avg. price corn (\$/bu)	Total sediment loss reduction (tons)	Total P loss reduction (lbs)	Total CO ₂ Reduction (lbs)	Average tillage cost savings per field (\$/acre)	Average yield difference, BMP strip vs. check strip (bu)	Average net economic returns per field (\$/acre)	Average payout to famer (\$/acre)	Average program cost (\$/acre)	Average sediment loss reduction per field (tons/acre)	Average P loss reduction per field (lbs)	Average CO ₂ reduction per field (lbs/acre)
2006	13	614.1	\$ 2.20	921.15	1228.20	307.05	\$ 8.97	\$ (19.71)	\$ (34.40)	\$ 30.37	\$ 47.00	70.86	94.48	23.62
2007	13	525.4	\$ 3.50	788.03	1050.70	262.68	\$ 10.84	\$ (3.98)	\$ (2.10)	\$ 30.14	\$ 46.69	60.62	80.82	20.21
2008	8	561.1	\$ 4.75	841.58	1122.10	280.53	\$ 16.71	\$ (4.67)	\$ (5.87)	\$ 21.08	\$ 34.46	105.20	140.26	35.07
2009	5	351.3	\$ 4.00	526.95	702.60	175.65	\$ 5.00	\$ (6.81)	\$ (21.70)	\$ 24.24	\$ 38.73	105.39	140.52	35.13
Avg./yr.	9.75	513.0	\$ 3.61	769.43	1025.90	256.48	\$ 10.38	\$ (8.79)	\$ (16.02)	\$ 26.46	\$ 41.72	3000.00	105.29	28.51
Avg./acre	-	-	-	1.50	2.00	0.50	\$ 10.89	\$ (9.73)	\$ (16.15)	\$ 26.72	\$ 36.08	1.50	2	0.50
Total	39	2051.8	-	3,077.70	4103.60	1025.90	\$22,334.92	-	-	\$54,828.88	\$74,024.99	-	-	-

Figure 5. Frequency distribution of net returns per acre for reduced tillage, 2006-2009.



E. Agflex Financial Performance

Agflex was incorporated in Iowa as a for-profit corporation in 2000 after the collaborators were unable to find an existing entity willing to bear the risk of making payouts to farmers. Lack of proof of market and insufficient data available to document frequency and amounts of payouts were a barrier for traditional insurers and reinsurers, including crop insurance companies.

Agflex was formed and reserves created by borrowing funds from the Iowa Department of Economic Development and American Farmland Trust. Agflex provides commercial service agreements to farmers, not insurance policies. Agflex provides consulting and special expertise to participating farmers and provides a contractual performance guarantee for that the advice and service. Agflex's commercial service agreement does not provide indemnification for fire, wind, hail, flood, drought or other perils typically covered by insurance. The check strip approach effectively isolates differences in yield to the practice implemented with the advice of the crop consultant provided by Agflex.

For the 2007 growing season, Agflex developed a per acre fee calculation based on the historical payouts for each of the three programs (nutrient, planned N reduction and reduced tillage). The fee is based on historical payouts, adjusted for the current year corn price, plus administrative costs of 30% and contribution to reserves of 5%.

The administrative portion of the fee pays for staff time to prepare/update forms, correspond with project partners including crop consultants and producers, respond to inquiries, pursue and receive completed forms from participants, enter data, calculate net returns, report results back to crop consultants and producers, and administer farmer and crop consultant payments, etc. These costs are the variable costs associated with having acres on the ground.

The advantage of developing a flat fee regardless of actual payouts is that producers are guaranteed full compensation for negative net returns regardless of availability of grant funds. Agflex commits in writing to provide full payment to producers, and maintains adequate reserves to make full payment in the event of a worst case scenario. Each year, Agflex calculates worst case scenarios and limits acres enrolled to stay within its capacity to make all payments.

Through 2009, payouts to farmers have ranged from a low of 14% of fees (2009 nutrient management, 319 acres enrolled) to a high of 83% (planned N reduction, 2459 acres enrolled). Overall, on average, Agflex has paid out to farmers 65% of the guarantees it charges to funders, maintaining its planned 35% gross margin (fees minus payouts) of

35%. This gross margin covers administrative and operating costs, maintenance of sufficient reserves to make payments in worst case years, and contribution to profits which are required to meet loan repayment obligations to initial creditors and to build reserves required continue to expand the program. Agflex has been profitable since 2007. All after-tax earnings have been retained by the corporation to meet reserve requirements, except for funds used for loan repayment. Current outstanding loan obligations are approximately \$100,000 and loan payments are on schedule as per initial loan agreements.

Additional costs to Agflex for grant-funded projects include coordinating project conference calls, recruiting participants, preparing grant performance reports, data analysis, results summaries, etc., bookkeeping, grant financial reports, preparing and administering subcontracts, invoicing funders, processing/paying subcontractor invoices, payroll, etc. These additional costs also include personnel costs for administering the project overall, project planning and evaluation, supervising staff, working with subcontractors, development for new crops and practices including data analysis and projections, meetings, conference calls, emails, presentations at conferences, etc. These are costs associated with running the project and developing the BMP CHALLENGE program and are included in personnel and fringe budget lines in the CIG and other proposals to funders. Payments to crop consultants are included in the contractual line item.

Agflex provides a model for a new type of Technical Service Provider, identifying late-adopter farmers, providing both technical assistance and verified foregone income protection, and increasing adoption. At 35% ratio of expense to delivery of foregone income payments to farmers, Agflex is cost efficient compared to NRCS which we estimate runs a 40% ratio of expense to delivery of program funds to farmers. In addition, Agflex targets payments to farmers with opportunities to improve practices, verifies implementation, documents outcomes including impacts on yields, net income and natural resources, and compensates only those farmers suffering net economic losses.

For additional discussion on integrating the BMP CHALLENGE approach to increase BMP adoption and protect farmers from foregone income in NRCS programs, see Appendix B.

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Appendix A. About the BMP CHALLENGE

The BMP CHALLENGE: Accelerating Agriculture's Contribution to Clean Water

Agriculture is our number one water user nationally, consuming 29 billion gallons annually. Agriculture is also our number one source of nutrient and sediment pollution. Best management practices, including nutrient management and conservation tillage, can make significant contributions to improved water quality, a critical current priority in the Mississippi River and Chesapeake Bay Watersheds.

Unfortunately, adoption of both well-established and advanced practices remains well below potential. According to a 2009 CTIC/Fertilizer Institute survey, nearly half of farmers do not follow university recommendations for testing soil for nutrients. Our own 2005 survey, with 700 corn grower respondents, found that 14% do not credit the nitrogen contribution from soybeans and 25% do not credit contributions from manure. Only 12% reported using late-spring nitrogen testing and application, a practice with potential to reduce nitrogen losses by 25 to 50%. Conservation Effects Assessment Program (CEAP) reports released in 2010 for the Upper Mississippi River Basin and the Chesapeake Bay watersheds indicate 15 to 20% of cropland acres in those watersheds are severely undertreated with conservation practices, and 60 to 80% of acres could benefit from additional proven nutrient management practices.

More than twenty studies have identified foregone income as a primary reason that farmers do not adopt conservation practices. Extra inputs are a rational defense against income loss. For example, heavy rains in spring and early summer can wash away nutrients before they are taken up by the crop. Bumper crop growing conditions can call for more nutrients than university recommendations provide.

In our 2005 survey, 80% of respondents would reduce fertilizer rates if income were protected. The BMP CHALLENGE provides this protection. Developed by American Farmland Trust and Agflex with support from NRCS and others, the BMP CHALLENGE:

- Isolates foregone income by using check strips in farmer fields. The farmer applies his or her conventional nutrient management or tillage practice in the check strip. The rest of the field receives the BMP.
- A net returns assessment at harvest determines impact on farmer net income.
- Farmers are compensated if net income declines.
- A third-party crop advisor supports and verifies implementation on site.

The BMP CHALLENGE has worked on more than 15,000 acres nationwide.

- Prior to participation, 53% of farmers were applying 25 lbs. or more nitrogen over and above University recommendations.
- In our 2005 survey, 94% of participants were satisfied and/or would recommend the practice to others.
- 59% will reduce their nitrogen application rates as a result of participation.

The BMP CHALLENGE has delivered:

- Reductions of an average of 40 lbs of nitrogen per acre per year.
- Reductions of two lbs. of phosphorus and 1.5 tons of sediment per acre per year.
- Reductions of thousands of lbs. of nitrous oxide (N₂O) and carbon dioxide greenhouse gases.

The BMP CHALLENGE can play a key role in accelerating agriculture's contributions:

First, it provides for on-farm adaptive management while addressing the late adopter's fear of lost income when he or she experiments with well-established conservation practices.

Second, it supports farmers when they try advanced conservation systems – such as the pre-sidedress or late-spring nitrate test – with potential for 25 to 50% savings in nutrients but not widely adopted because of justifiable concern about lost income in some years.

Third, it enables below-BMP application rates which are necessary and cost-effective approaches to achieve water quality goals in nutrient-impaired watersheds. Over the past five years, we have used the BMP CHALLENGE to keep more than 180,000 lbs. of nitrogen out of the Chesapeake Bay Watershed at a cost of less than \$3 per pound, very competitive with costs of other practices.

Finally, the BMP CHALLENGE provides a mechanism to document foregone income and environmental benefits. Congress recognized foregone income in EQIP to replace the Incentive Payments not allowed under World Trade Organization green payment rules. NRCS can compensate farmers up to 100% of foregone income. Figuring income foregone for some practices is relatively easy -- installing a filter strip of X size reduces corn production by Y amount. Figuring income forgone for nutrient and tillage management practices is much more complex. They are the top priorities for which the agency has stated desire to use the "income foregone" tool. Our system provides this solution. In addition, our system supports water quality credit trading, an opportunity for wastewater discharge permit holders and others to financially support water quality improvements generated by farmers at lower costs than treatment plant upgrades. The BMP CHALLENGE has potential to reduce trading costs by providing farmers with assurance that they will not lose income when they implement BMPs to generate credits, and by providing a mechanism to verify practice implementation.

We need agriculture to feed an additional 2.2 billion people worldwide by 2040, contribute to energy self-sufficiency, keep our landscapes attractive and revitalize our rural communities. We need to make the BMP CHALLENGE widely available to both conservationists and farmers to reduce and improve agriculture's impacts. This is affordable and feasible. For example, applying the Nutrient BMP CHALLENGE to the four million acres practices in the Upper Mississippi River Basin identified in the CEAP report as very undertreated with conservation could reduce nitrogen inputs by 25 to 50% at a cost of \$42 per acre, or \$168 million. Providing this experience to farmers will result in 59% or more continuing to maintain the practice on their own.

Contact: Brian Brandt, American Farmland Trust, 614 221-8610, bbrandt@farmland.org
Thomas Green, BMP CHALLENGE, 608 232-1425, tom.green@bmpchallenge.org,
www.bmpchallenge.org

Appendix B. Questions and Answers about the BMP CHALLENGE Adoption System

This memo lays out the basic rationale for an income foregone guarantee adoption system and offers alternatives for implementation. It is in a Q and A format. In this way it can both describe the system and address questions about it. (Updated for 2011 corn prices of \$6.10/bu. on April 18, 2011.)

Q and As 1-10 describe the rationale of the BMP CHALLENGE system.

Q and As 11-19 answer FAQ's.

Concluding discussion following the Q and As demonstrating that the operator of the BMP CHALLENGE system is a TSP under the EQIP regulations.

(1) Should NRCS incorporate an innovative system like BMP CHALLENGE into its programs?

Yes – for three basic reasons:

1. It is the President's policy. President Obama in section 202 (a) of his Chesapeake Bay Executive Order has called on USDA -NRCS to develop the "next generation of tools and activities to restore water quality".
2. For NRCS to achieve its legal mandate to protect the natural resource, it must achieve high levels of BMP adoption. According to CEAP as many as 30% of the acres in the Upper Mississippi River Basin are undertreated with conservation practices.
3. The NRCS has explicit authority in § 1466.10 Subpart B to use its EQIP authority to support "new... management approaches that provide a high potential for optimizing environmental benefits.... (through) "interim practice standards" using EQIP payments.

(2) How was the BMP CHALLENGE system developed?

The development of the BMP CHALLENGE system began 15 years ago with the support of Pearlie Reed and Tom Weber. They provided funding to the Agricultural Conservation Innovation Center (ACIC), a project of the American Farmland Trust, "to think outside the box" to find ways to overcome the low BMP adoption rates. ACIC pursued many different options. The BMP CHALLENGE system is the one that has proved workable and effective. It saves nitrogen at about the same cost/lb. compared to the next best alternative, provides technical support and verifies implementation. (see Q and A # 17below.)

ACIC extensively researched BMP adoption literature and found that it frequently cited economic failure as a key barrier to adoption. In EQIP terms this is "income foregone variability." The BMP CHALLENGE system was developed to address this barrier.

(3) If BMP's lower production costs why should NRCS address farmers' fears that they may lose money if they adopt a BMP?

The simple answer is that we have to if we are going to get late adopters to try BMP's.

The following brief summary of key adoption research will explain why.

In the course of our research we found that fear of income loss (negative income variability) was a key barrier to adoption.

(1) An ERS survey asked farmers why they have not adopted common BMP's. The respondents identified two factors – (a) BMP's are more labor intensive and (b) fear of economic loss. (lines 3 and 4 below) Note that the survey found that farmers understand the BMPs and think that they save money. (lines 2 and 5) Information is not the issue. The BMP CHALLENGE system addresses this fear of "income foregone" identified in this ERS survey.

Table 1—Effect of producer perceptions on the adoption of five BMP's¹

Producer perception/ knowledge	Expected result	Best management practice				
		Manure crediting	Legume crediting	Irrigation scheduling	Soil nitrate testing	Split application of nitrogen
Aware of the ET&FA program	+	+	+	—	+	—
Familiar with BMP's	+	+	+	+	+	+
Consider BMP risky	—	+	—	+	—	—
Consider BMP labor intensive	—	+	—	—	—	—
Believe BMP increases profits	+	+	+	+	+	+
Believe BMP improves farm water quality	+	+	+	+	+	—
Acres in corn	+	+	+	+	+	+
Dairy cattle present ²	+	+	NA	NA	NA	NA
Beef cattle present ²	+	+	NA	NA	NA	NA

¹Statistically significant at the 5-percent level. ²Statistically significant at the 10-percent level.

NA = Not applicable.

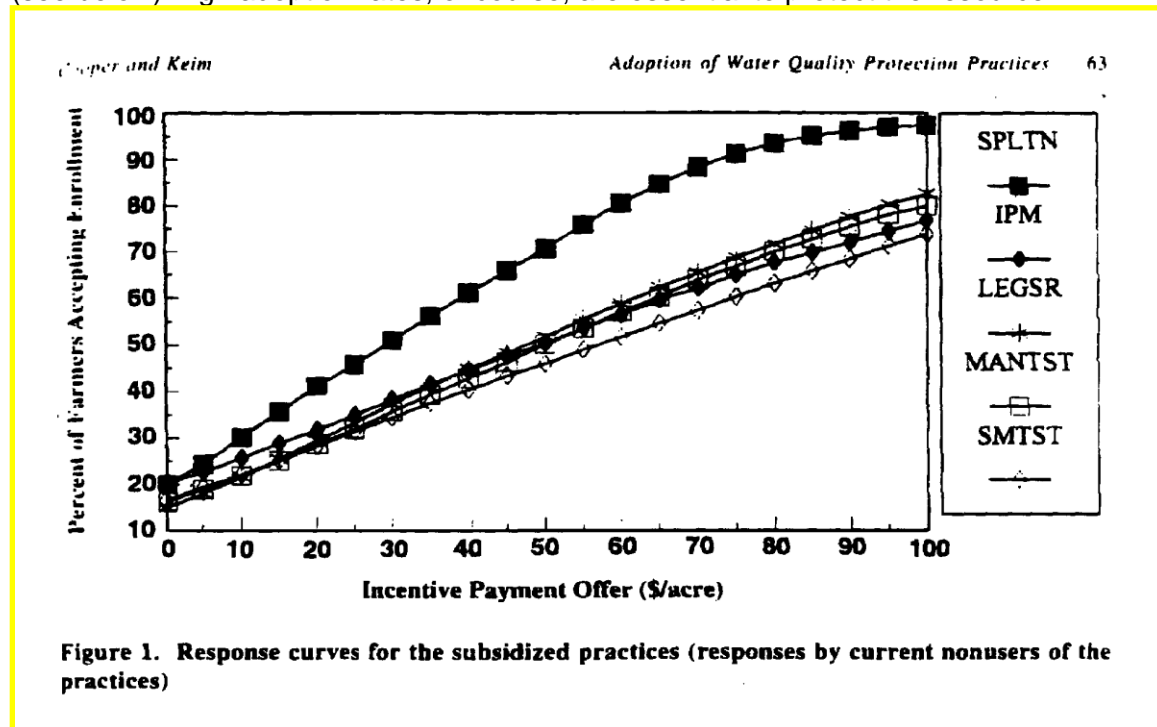
¹The effects of producer knowledge, characteristics, and perceptions of each BMP on the adoption rate derived from a probit analysis of adoption behavior. The dependent variable equals one if the individual adopted the practice, zero otherwise. A "+" means a variable has a positive effect on BMP adoption rates; a "—" means a variable has a negative effect on BMP adoption rates.

²Used to describe the decision to adopt manure crediting only.

Source: Feather and Amacher, 1994.

(2) Farmers believe that adopting BMP's may be very costly. In a second survey (chart below) ERS asked farmers what level of incentive payment would be needed to induce them to adopt well known BMP's. The survey found that to

achieve even a 50% adoption rate it would have to provide an incentive payment of \$70/acre. (see below) High adoption rates, of course, are essential to protect the resource.



Offering a payment at such a high level (\$50) is budgetarily unsustainable. However, a high level of adoption is necessary to protect the natural resource. Since we know that most farmers using BMP's reduce costs, the most economically efficient system to address the income foregone fears of late adopters is not to provide a very high payment for all farmers. Instead it is to utilize a system that pays only those who suffer losses. That is what the BMP CHALLENGE system does.

A system that addresses negative income variability is especially important because limited resource farmers have the thinnest margins and cannot afford losses. Thus it is not surprising that beginning and limited-resource farmers are less likely to participate in EQIP than the U.S. farm population as a whole. These two farmer types operated about 27 percent of all farms in 2006 but held only 12 percent of EQIP contracts

Other academic studies on the role of income loss in adoption are available on request.

Looked at together the two ERS studies establish the need for a system to address the very high levels of economic insecurity of late adopters. Such a system must be part of the NRCS programs.

(4) Is the BMP CHALLENGE system based on the premise that BMP's don't work? Does it undermine BMP's?

This is a very important Q and A.

There is some concern within NRCS that if the Service includes the BMP CHALLENGE system in its programs it will undermine or contradict the advice that it has given farmers over the years – that BMP's are good for the farmer's bottom line. This is case because the BMP challenge data does show, what experts have also recognized, that in some years some farmers lose BMP related yield during the adoption period.

This issue must be approached carefully so that misunderstandings can be cleared up.

A basic nutrient management BMP is not economically risky because over time it makes farmers better off financially.

However in some years a farmer using a BMP may lose income. As the landmark National Academy of Sciences study put it:

“Producers face a management dilemma because the effectiveness and efficiency of nitrogen management cannot be assessed, economically or environmentally, until the growing season is over. A crop that produces poor yields because of inclement weather will result in poor nitrogen use efficiency and uptake, nitrogen to be lost to the environment, no matter how carefully a management plan was designed. Since producers must make nitrogen applications without being able to predict weather and crop yields, the potential for being wrong is always present and will always occur in some years.”

If a late adopter “foregoes” income in the early years, he will drop the system. That is why the BMP CHALLENGE system was developed.

It is not per se a risk management system. It is an adoption system that helps late adopters to try out a BMP without fear of losing income – “income foregone.”(Early adopters understand that in some years BMP's produce net income and some they do not. They believe that the good years will outweigh the bad. Late adopters do not.) (See Q and A 8 below)

Rather than being anti- BMP, the BMP CHALLENGE system is based on the assumption that BMP's do work and that if we can get late adopters to try them, many will adopt them. The BMP CHALLENGE system works precisely because BMP's save production costs for most farmers. About 60% of the famers who use the BMP CHALLENGE system adopt the BMP – according to our post participation surveys. This is consistent with the fact that about 60% of the farmers find their income goes up or they break even. In discussing the BMP CHALLENGE system too much emphasis has been placed on the producers who lose income. Most late adopters who try a BMP under the BMP CHALLENGE system adopt it because it is economically profitable. These producers would not have even tried the BMP without an income variability guarantee during the adoption process.

(5) Is the system a “crop insurance” like risk management system?

Because BMP's are economically sound they are not “risky.” Thus a system that addresses income foregone variability during the key adoption period is not a “risk management” system. It is an adoption system that protects the late adopter from income foregone during the three year adoption period which the BMP CHALLENGE covers.

The BMP CHALLENGE system does not pay farmers for losses related to normal yield variability. The check strip system isolates the cause to BMP related failures. (No financially affordable system can pay for routine yield variability.)

It is not insurance. State regulators in Iowa and Illinois have examined the system and determined that it is not insurance. It is an adoption tool to address the income foregone some later adopters will experience when they try a BMP. It is akin to a warranty. A warranty induces a person to purchase a product - even though the failures of the product are not common.

(6) Is the BMP CHALLENGE system mature enough that it should be widely available?

Yes, it has been developed through CIG grants under the Service's technical and economic supervision over 6 years on 16,000 acres. In that process it has been carefully refined and adjusted with the participation of university agricultural experts. The Service can be confident that it is technically and economically sound. It is not an "idea that has been tried on a few farms. - It is a real proven operating system ready for wide use.

It is time that NRCS reap the benefit of its investment and graduates this system into its programs.

Wouldn't Congress and OMB like to see that the large sums invested in the CIG program are bearing fruit?

(7) The BMP CHALLENGE system is more costly than standard nutrient management plan. (About \$42/acre at 2011 corn prices) Is it cost effective?

Yes. The BMP challenge system saves N at a cost of \$1.87/pound compared to standard nutrient implemented plans at \$1.66/lb. and cover crops at \$2.33 to \$3.50/lb. (see Q and A 17)

(8) How does it work on the ground?

1. The managing organization recruits a crop adviser TSP. The crops adviser often views the BMP CHALLENGE Performance Guarantee as a "foot in the door." He is motivated to use it to show the farmer that he can be more profitable if he adopts BMP's. District conservation specialists can also use the system.
2. Crop advisers identify farmers who have been unwilling to use BMP's.
3. The TSP lays out a test strip on which the old practice is utilized. The crop consultant TSP ensures that the soil characteristics of the test strip and the adjacent land are as similar as possible.
4. In the rest of the field (up to 150 acres) the farmer uses the BMP. At the end of the year the test strip yield is compared to the yield on the adjacent strips on which the BMP has been utilized
5. If the BMP works for the farmer he usually adopts it. If the BMP yield is lower he receives a payment for the difference, net of savings.
6. If the system is adapted to the NRCS system the payments to producers for participation in the BMP challenge practice would be pooled and paid to the TSP so that the guarantee can be paid to the farmer who loses income.

(9) Why does it work differently than a typical BMP cost-share?

First, the premise of an adoption guarantee system targeted to late adopters is the opposite of a standard cost share system. The assumption behind a standard system is that "the BMP is

going to lower the farmer's costs, so all we need to do is to cover his start up costs to secure adoption.” The problem with this approach is that late adopters do not buy the premise – they do not believe that the BMP will lower their production costs. Indeed they fear the opposite – that the BMP will cause yield loss and reduce their income. (see ERS data above.)

Second, it is marketed differently. Late adopters are farmers who do not take the initiative to try new practices or go to the NRCS office to enroll in programs. That is why the BMP CHALLENGE system is marketed to conservation professionals and independent crop advisors. They in turn approach the late adopters with the offer of an opportunity to try BMPs “risk free.”

Pete Nowak, long-time rural sociologist at the University of Wisconsin, summarizes the problem --“...environmental systems are often driven by a small amount of inappropriate behaviors occurring in especially vulnerable places... These disproportionate impacts often escape our efforts to develop remedial policy because programs are often designed for the average.”

Late adopters are by definition not “average”.

(10) Can you give examples of where the BMP CHALLENGE System has worked?

Dave Legvold, former director of the Cannon River Watershed Partnership in Minnesota puts it this way, “The BMP CHALLENGE has allowed us to get on farms we have never been able to before. We can assure the farmer there is no chance he will lose income by working with us to try the practice we’ve been unable to get him to look at in the past. To the farmer, it is a no brainer.”

The CIG advisory committees which have reviewed the program’s operation over the last three years all continue to support it. Attending the review sessions were; representatives of a variety of agricultural experts and agricultural and environmental groups including: MD and PSU extension fertility specialists, SWCD’s, PA State Conservation Commission, PA and MD Departments of Ag, Chesapeake Bay Commission, PA and MD Farm Bureau, Chesapeake Bay Foundation and crop consulting companies.

(11) How can the BMP CHALLENGE system work within the present NRCS payment system?

We know from years of data on thousands of acres which we have collected and analyzed that it costs approximately \$42/acre at current corn prices to operate an income foregone guarantee program for nutrient BMP’s. (By way of comparison about \$23/acre is paid for “income foregone” in the NM conservation tillage payment schedule. Payments of between \$20-30/acre have been provided for “Acquisition of Technical Knowledge” in Iowa.)

Of the \$42 needed to operate the BMP CHALLENGE system, \$28 covers the payments to the farmers who lose income. It costs \$14/acre to cover the costs of the test strips used to determine the loss payment, manage the contracts and make the payments. These are not projections. They are based on many years of CIG experience. The \$14 is 32% of the total cost -- a typical level paid to private entities by USDA in programs where a benefit is delivered by a private entity.

Based on these suggestions we propose two alternatives:

A. All Income Foregone authority

1. \$28 under Income Foregone
2. \$14 under Income Foregone using TSP authority
 - i. 100% of the costs of determining if income is foregone and providing an income foregone can be covered. The 75% limit does not apply to providing an income foregone system. It applies only to the cost of "implementing the conservation practice." (1466.23 (c)(i)).
 - ii. NRCS has recognized that inherent in the EQIP payment system is the authority to provide funds for its implementation through a TSP. The same principle applies to a TSP who provides an income guarantee and thus Income Foregone funds can be used for this purpose.

B. Part EQIP, Part TSP or Coop Agreement

- a. \$28 under Income Foregone.
- b. \$ 10+ under monitoring and Acquisition of Technical Knowledge (75% limit)
- c. Cover the remaining amount utilizing TSP authority under 652.3(e) which has funded single entities to provide CNMP's for groups of producers (or a coop agreement.) \$100,000 would cover about 20,000 acres.
- d. Section 1466.10(d) specifically foresees this type of situation. In states:
 - i. "Where new management approaches that provide a high potential for optimizing environmental benefits have been developed, NRCS may provide financial assistance for pilot work to evaluate and assess the performance, efficiency and effectiveness Of the new management approach."

(12) Should NRCS offer a practice where there is only one supplier?

There is not a sole supplier. Many entities can offer the BMP CHALLENGE. Two non-profit entities, AFT and the IPM Institute, now operate the program backed by Agflex.

Agflex is the only TSP guarantor at this time. There are no significant entry barriers to entry. All of the financial data needed are a matter of public record in the CIG files. Further, Agflex will make its services available at the approved rate to any organization that operates the program according to the practice standards. The existing cost schedule has been developed in the CIG process and found reasonable by NRCS staff as well as the Pennsylvania Department of Environmental Quality.

(13) Why is there a for-profit entity involved – Agflex?

The USDA supports public- private partnerships in many areas. The BMP CHALLENGE system is one. This is, as they say, "a good thing" -- just as is NRCS's support of crops consultants.

Here's how this situation developed. NRCS funds were provided to a non-profit – ACIC-AFT - to begin development of income guarantees for BMP adopters. Some entity must guarantee the payment to farmers who suffer losses. Neither AFT nor any non-profit was willing to take the economic risk inherent in a making the guarantee. ACIC-AFT could not raise funds to fund a reserve from any foundation or public source. Agflex was, however, able to raise the necessary reserve funds as a private corporation from the Iowa Department of Economic Development. IDED saw this an innovative private sector initiative that could help Iowa's need to address farm related pollution. Agflex has made these reserves available so that the program will work.

If the only barrier to the establishment of the income foregone performance guarantee system is that Agflex is a for-profit entity we will re- structure Agflex as a non-profit.

(14) Why not just give farmers a high cost share payment and let them choose to use the guarantee, or not? Should the payment be tied into participation in the system?

Yes. If a practice standard requires that a certain activity be provided by a TSP, the producer must contract with a TSP to provide it. Otherwise, the farmer is getting funds and not using them for the purposes the practice requires. This is the case in NRCS IPM practices, for instance.

Further, to provide all farmers with a payment at a level necessary to fund an income foregone variability system would waste large amounts of funds because many farmers will adopt without the guarantee.

Finally, if the income foregone guarantee is not tied to participation in the guarantee system the Service will also lose all the ancillary benefits including verification of nutrient savings and the establishment of the crop adviser-farmer relationship.

(15) Are separate rates justified under one practice?

Iowa has four rates ranging from \$6 to \$20 for 590 practices that are conceptually different. There are also different rates for different conservation tillage adoption systems in the present system. The income guarantee system should be funded at a different rate as well.

(16) Can NRCS cover "overhead?"

The NRCS now covers the administrative costs of delivery services through TSP's. The manager and guarantee providers are TSP's.

(17) Why are costs higher than typical nutrient practice payments?

The cost of the BMP guarantee practice is higher because it offers more to the farmer including an independent crop adviser and an income foregone guarantee. But it is very cost effective.

It is less costly when compared to other N reduction options on a cost per pound of N saved. The BMP CHALLENGE program data show that, where it guarantees a BMP, it saves N at a cost of \$1.87/pound. That is comparable or less than the cost of the next best options. A 2004 study by the Chesapeake Bay Commission of the most cost-effective strategies for reducing nutrients to the Chesapeake Bay found that the five most cost effective strategies for reducing nitrogen to the Bay cost between \$1.57 and \$8.56 per pound of nitrogen reduction.

- Wastewater treatment upgrades - \$8.56/lb of N
- Nutrient management plans and implementation - \$1.66/lb of N
- Enhanced Nutrient Management - \$4.41/lb of N
- Conservation tillage - \$1.57/lb of N
- Cover crops – \$2.33 to \$3.50/lb of N

These estimates are based on one year of savings and do not assume an adoption rate of a certain number of years. The multiple year cost/lb is thus much lower.

(18) Does it make sense for the payment to each farmer is pooled and only the farmers who lose income are compensated?

It does for several reasons:

- (1) It is more economically efficient to only pay the high costs of those that lose income rather than paying a high payment to those who profit from it.
- (2) Those for whom the BMP works have received a benefit – assistance in establishing the BMP which has increased net returns.

(19) Should we make a payment to farmers to cover losses, when some of the producers suffer no losses?

There is the perception that the farmer who gets a \$28 Foregone Income payment, but suffers no loss is getting nothing. That is not correct. He is getting a guarantee. It has substantial economic value. Think of a termite treatment. It costs you a \$100 to get an exterminator to spray for the bugs. The salesman says “for another \$10 a year we will guarantee against termite damage for X years.” You pay that extra \$10 and get something real for it – a guarantee – even if you never have termite damage. As noted above those who adopt also get a real economic benefit of a BMP that saves them operating costs that they would not have saved otherwise.

When NRCS funds the basic \$28 needed to provide income protection during the adoption period NRCS is buying that guarantee for the late adopter. It is a real value to the producer.

The following memorandum provides the regulatory citations supporting the fact that a BMP Income Foregone Guarantor is a TSP under the EQIP program definitions.

An Entity Which Provides an Adoption Guarantee is a “Technical Service Provider.”

Summary:

An adoption guarantor is a Technical Service Provider because:

- 1) it provides the **technical infrastructure** – planning and guarantee system

- 2) to deliver the technical services (guarantee) which assists .. the implementation of the conservation practice”
- 3) which is a “tool necessary” to achieve the “conservation of natural resources” though increased adoption of a BMP.

The regulation reads as follows:

Technical assistance means technical expertise, information, and tools necessary for the conservation of natural resources on land active in agricultural, forestry, or related uses. The term includes the following:

- (1) Technical services provided directly to farmers, ranchers, and other eligible entities, such as conservation planning, technical consultation, and assistance with design and implementation of conservation practices; and
- (2) Technical infrastructure, including activities, processes, tools, and agency functions needed to support delivery of technical services, such as technical standards, resource inventories, training, data, technology, monitoring, and effects analyses.

Technical Service Provider (TSP) means an individual, private-sector entity, or public agency certified by NRCS to provide technical services to program participants, in lieu of or on behalf of NRCS

Discussion:

Begin with the definition of “Technical Assistance.”

Technical assistance means “(a) tool necessary for the conservation of natural resources.... (such a tool is a BMP)

Adoption guarantees are “tools necessary... to secure adoption” by a late adopters. (Citations available)

Technical services in paragraph (1) are “services provided directly to farmers (that) assist with the implementation of conservation practices.”

Adoption guarantees are a “service provided to farmers which assist in the adoption of BMP’s.—i.e. “assist with the implementation.” They induce late adopters to adopt.

Technical infrastructure, include(s).....activities needed to support the delivery of technical services...” (one of which is to “assist with implementation of conservation practices.”)

The adoption guarantor provides the “services that assist adoption by providing a guarantee “on behalf and in lieu of NRCS.”

In summary:

An adoption guarantor is a Technical Service Provider because:

- (1) it provides the technical infrastructure – planning and guarantee system
- (2) to deliver the technical services (guarantee) which assists .. the implementation of the conservation practice”
- (3) which is a “tools necessary” to achieve the “conservation of natural resources” though increased adoption of a BMP.

The regulatory authority to use EQIP funds to pay for TSP’s is found in the following sections of the regulations effective February 4, 2010.

Under the subpart B entitled “Contracts and Payments”

PART 1466—ENVIRONMENTAL QUALITY INCENTIVES PROGRAM

Subpart B—Contracts and Payments

§ 1466.11 Technical services provided by qualified personnel not affiliated with USDA.

(a) NRCS may use the services of qualified TSPs in performing its responsibilities for technical assistance.

(b) Participants may use technical services from qualified personnel of other Federal, State, and local agencies, Indian Tribes, or individuals who are certified as TSPs by NRCS.

(c) Technical services provided by qualified personnel not affiliated with USDA may include, but are not limited to: conservation planning; conservation practice survey, layout, design, installation, and certification; and information; education; and training for producers.

(d) NRCS retains approval authority of work done by non-NRCS personnel for the purpose of approving EQIP payment

Title 7: Agriculture

PART 1466—ENVIRONMENTAL QUALITY INCENTIVES PROGRAM

Subpart B—Contracts and Payments

§ 1466.10 Conservation practices.

(d) Where new technologies or management approaches that provide a high potential for optimizing environmental benefits have been developed, NRCS may approve interim conservation practice standards that incorporate the new technologies and provide financial assistance for pilot work to evaluate and assess the performance, efficiency, and effectiveness of the new technology or management approach.

Appendix C. Project Team, Advisors and Trainers

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Advisory Group

Participation is invited on monthly conference calls and requested for quarterly conference calls and one in-person meeting per year. Role includes reviewing plans and progress, and responding to requests for

information/assistance from project team.

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Trainers

Individuals trained to offer the BMP CHALLENGE and WQ Credit Trading curriculum developed as part of this project. Goal was to identify and recruit individuals whose professional role would be enhanced by this capacity.

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APPENDIX D. AFT Pennsylvania Credit Calculation Form

CREDIT CALCULATION FORM- Effective December 4, 2007

This form will help assist the agricultural sector in determining how many nitrogen reduction credits may be generated from the implementation of particular Best Management Practices (BMPs). Calculations on this sheet are based on expected yield. This form should be completed and submitted to Pennsylvania Department of Environmental Protection (PA DEP) as part of a proposal to generate credits. A submitted proposal should follow the guidelines outlined in the Trading of Nutrient and Sediment Reduction Credits- Policy and Guidelines¹ regarding submission criteria for approvals of activities that reduce nutrients and potentially create credits. Please check the PA DEP Nutrient Trading Website or Pennsylvania's Water Quality Trading Marketplace² to ensure you are using the most up-to-date Credit Calculation Form.

1. The Final Trading Policy can be found on the PA DEP Trading Program website at: http://www.dep.state.pa.us/river/river_trading.htm
2. Pennsylvania's Water Quality Trading Marketplace (<http://pa.nutrientnet.org>) is an online trading platform where users buy and sell credits under PA's Trading Program.

To complete this form please fill out all required fields in yellow. Dark blue fields are automatic calculations performed on the spreadsheet. The annual credit generation period is October 1-September 30th.

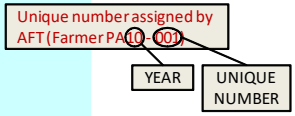
Red text tells you where to find the correct data to enter into each cell

Information taken from:
Supplemental Application (SA) and BMP Challenge Field Information Form

Date: _____
Project Name: _____

Contact Information¹
Name: Jim Baird
Organization: American Farmland Trust
Phone Number: (202) 378-1235 ext. 235
Email Address: jbaird@farmland.org

1. This is the contact information for the person submitting the proposal to DEP.



1. Baseline Requirements to Generate Credits

a. Is farm in compliance with Act 38 Nutrient Management Regulations, Chapter 102 Erosion & Sedimentation Regulations, Chapter 91.36 (for agricultural operations), and Chapter 92 (for CAFO operations), as applicable?
 _____ #1 on SA

b. Who has verified compliance in part (a.):
 _____ Other Authorized Agent
 If other, please explain: _____ TeamAg

2. Threshold Requirements to Generate Credits

If a 35 ft or greater riparian buffer is currently in place, please fill out the next question below.

Type of Buffer _____
 Total Acres of Land in Buffer Strip _____ acres

#3 on SA, Fill in if applicable

*Compliance can be determined through a site inspection or verification of the development and implementation of a Nutrient Management Plan, E&S Plan (or an acceptable conservation plan), or Manure Management Plan, as applicable.
 **In order to meet the threshold for a buffer, a minimum of 35 ft of permanent vegetation should be established and maintained between the field and surface water. The area can be grazed or cropped under a specific management plan, however permanent vegetation must be maintained at all times; Permanent vegetative buffers greater than 50 ft in width may qualify to generate nutrient reduction credits.

3. General Information

a. Current crop:¹ _____
 b. Acres of Current Crop: _____
 c. Expected yield: _____ 0 per acre See BMP Challenge Application
 d. Current tillage method: _____
 e. Watershed segment number: _____ #1 on SA

See BMP Challenge for information on this section

BMP Challenge Field Info: select corn for grain or corn for silage

1. If your current crop is not listed, contact PA DEP Water Planning Office (717-772-4785) for a more specific calculation methodology.

Fill out all current AND planned sources of nitrogen applied to the field for the given year. Applications for the year may be separated out for different application times and manure types. Nitrogen credits may be generated if the planned nitrogen application is less than the current application (for example, a planned decrease in nitrogen application due better nutrient management)

4. Nitrogen Application¹

	Current	Planned
<div style="border: 1px solid black; padding: 2px; display: inline-block;">Fill this column with check strip information</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin-left: 20px;">Fill this column with reduced rate (i.e., 10% or 15% reduced application rate)</div>		
Application #1 <i>(Use if Needed)</i>		
a. Nitrogen applied from commercial fertilizer: ²	<input type="text" value="0.00"/> lbs/ac	<input type="text" value="0.00"/> lbs/ac
b. Total Available Nitrogen- Application #1:	<input type="text" value="0.00"/> lbs/ac	<input type="text" value="0.00"/> lbs/ac
COMMERCIAL FERTILIZER ONLY		
Application #2 <i>(Use if Needed)</i>		
a. Time of Year:	<input type="text"/>	<input type="text"/>
b. Manure type:	<input type="text"/>	<input type="text"/>
c. Do you have a recent manure analysis test? ³	<input type="text"/>	<input type="text"/>
If so, nitrogen concentration in manure:	<input type="text" value="0"/>	<input type="text" value="0"/>
d. Manure application rate:	<input type="text" value="0"/>	<input type="text" value="0"/>
e. Days until incorporation:	<input type="text"/>	<input type="text"/>
f. Total Applied Nitrogen- Application #2:	<input type="text" value="0.00"/> lbs/ac	<input type="text" value="0.00"/> lbs/ac
g. Total Available Nitrogen- Application #2:	<input type="text" value="0.00"/> lbs/ac	<input type="text" value="0.00"/> lbs/ac
MANURE ONLY: Page 2 on SA; time of application, rate, manure type, and incorporation		
Application #3 <i>(Use if Needed)</i>		
a. Time of Year:	<input type="text"/>	<input type="text"/>
Manure type:	<input type="text"/>	<input type="text"/>
Do you have a recent manure analysis test? ³	<input type="text"/>	<input type="text"/>
If so, nitrogen concentration in manure:	<input type="text" value="0"/>	<input type="text" value="0"/>
Manure application rate:	<input type="text" value="0"/>	<input type="text" value="0"/>
Days until incorporation:	<input type="text"/>	<input type="text"/>
Total Applied Nitrogen- Application #3:	<input type="text" value="0.00"/> lbs/ac	<input type="text" value="0.00"/> lbs/ac
Total Available Nitrogen- Application #3:	<input type="text" value="0.00"/> lbs/ac	<input type="text" value="0.00"/> lbs/ac
Application #4 <i>(Use if Needed)</i>		
a. Time of Year:	<input type="text"/>	<input type="text"/>
Manure type:	<input type="text"/>	<input type="text"/>
Do you have a recent manure analysis test? ³	<input type="text"/>	<input type="text"/>
If so, nitrogen concentration in manure:	<input type="text" value="0"/>	<input type="text" value="0"/>
Manure application rate:	<input type="text" value="0"/>	<input type="text" value="0"/>
Days until incorporation:	<input type="text"/>	<input type="text"/>
Total Applied Nitrogen- Application #4:	<input type="text" value="0.00"/> lbs/ac	<input type="text" value="0.00"/> lbs/ac
Total Available Nitrogen- Application #4:	<input type="text" value="0.00"/> lbs/ac	<input type="text" value="0.00"/> lbs/ac
Total Nitrogen Applied:	Current <input type="text" value="0.00"/> lbs/ac	Planned <input type="text" value="0.00"/> lbs/ac
Total Nitrogen Available for Crop Uptake:	Current <input type="text" value="0.00"/> lbs/ac	Planned <input type="text" value="0.00"/> lbs/ac
If you plan on reducing nitrogen applications ("Planned Nitrogen Applied" is less than "Current Nitrogen Applied" above), is this because:		
<input type="radio"/> Not Applicable <input type="radio"/> Farm is no longer importing manure <input type="radio"/> Farm is now exporting manure, or has increased manure exports <input checked="" type="radio"/> Other (please specify below):		
<div style="border: 1px solid black; padding: 2px;">Planned Nitrogen Reduction Program/American Farmland Trust</div>		
<p>1. If biosolids are applied as fertilizer, contact PA DEP Water Planning Office (717-772-4785) for a more specific calculation methodology. 2. Please total up all commercial fertilizer applications over the year and include them here. 3. There are no default nitrogen concentrations for treated manure in the spreadsheet-- please enter nitrogen concentrations for treated manure in the field below.</p>		

5. Residual Nitrogen¹

a. Frequency of past manure applications:

b. Residual N from previous crop:

Soil series type:

Yield if soybeans provide residual nitrogen:

		#5 on SA
Red clover or trefoil >50% stand		#6 on SA
		#7 on SA
	bu/ac	
Total Nitrogen from Residuals:	0.00	lbs/ac

1. Residual Nitrogen is the amount of nitrogen in the soil from previous manure applications or legume crops.

The section below gives a snapshot of nitrogen application and loading rates. The first heading, "Nitrogen Reductions from Change in Application Rate," determines if any nitrogen credits are received from a reduction in nitrogen application rates. Nitrogen application rates used in this calculation are found in line 85 of this sheet. The second heading, "Nitrogen Loading Calculations," determines the amount of nitrogen available for runoff, and is calculated by subtracting the nitrogen uptake from the crop by the total nitrogen on the field (from applied nitrogen and residuals). BMPs chosen in Section 7 below are applied against the "Nitrogen Load to Reach Edge of Watershed Segment" calculated here to determine the nitrogen reductions achieved by the BMPs implemented.

6. Nitrogen Application Reductions and Loading Snapshot

PSU Recommended Nitrogen Application Rate:¹

Nitrogen Available- Current:

Nitrogen Available- Planned:

Is "N Available- Planned" greater than PSU Recommended Rate?

Is farm able to generate credits?

0.00	lbs/ac/yr
0.00	lbs/ac/yr
0.00	lbs/ac/yr
0	
0	

Nitrogen Reductions from Change in Application Rate:

Edge of Field Nitrogen Reductions:²

Edge of Field Nitrogen Reductions:

EOS Ratio:

EOS Nitrogen Reductions:³

0.00	lbs/ac/yr
0.00	lbs/yr
(x) 0.00	
(=) 0.00	lbs/yr

Nitrogen Loading Calculations:

Total Nitrogen on Field- Planned:⁴

Nitrogen Uptake from Crop:⁵

Nitrogen Load to Reach Edge of Field:⁶

EOS Ratio:

Preliminary EOS Nitrogen Load:

N Reduction for Conservation or Continuous No-Till:

N reduction for currently having riparian buffers in place:

Nitrogen Load to Reach Edge of Watershed Segment:

Nitrogen Load to Reach Edge of Watershed Segment:

0.00	lbs/ac/yr
(-) 0.00	lbs/ac/yr
(=) 0.00	lbs/ac/yr
(x) 0.00	
(=) 0.00	lbs/ac/yr
(-) 0.00	lbs/ac/yr
(-) 0.00	lbs/ac/yr
(=) 0	lbs/ac/yr
(=) 0.00	lbs/yr

1. Source: Pennsylvania State Agronomy Guide and AASL Handbook.

2. Edge of Field Nitrogen Reductions= [(Current Nitrogen Applied)-(Planned Nitrogen Applied)]. Credit is not received for the decrease in nitrogen applications that exceed PSU recommended application rates.

3. The Edge of Segment (EOS) Nitrogen Reductions determines the amount of nitrogen reductions that reach the edge of the watershed segment from the farming field. The EOS Ratio is derived from the Chesapeake Bay Model.

4. Total Nitrogen on Field = [(Planned Total Nitrogen Applied) + (Total Nitrogen From Residuals)]

5. Nitrogen uptake from crops varies by crop type and expected yield. Source: USDA Plant-Crop Nutrient Tool.

6. Nitrogen Load to Reach Edge of Field= [(Planned Nitrogen on Field)-(Nitrogen Uptake from Crop)]. If the "Planned Nitrogen on Field" is less than "Nitrogen Uptake from Crop," then the Nitrogen Load is determined by [(Planned Nitrogen Applied) - (Planned Nitrogen Available)].

Use the drop down options below to select any number of BMPs to implement that may generate nitrogen credits. The total nitrogen reduced for all BMPs chosen in this section appears on Line 156. If you are only generating credits from reducing nitrogen application rates (calculated above) then you can skip this section.

7. Planned Nitrogen Reductions- Best Management Practices¹

a. Cropland and pasture BMPs to generate credits:

(use if needed)

(use if needed)

(use if needed)

1. Total acres of BMP:² acres

2. If cover crops will be planted:
Cover crop planting time:

b. Streambank BMPs to generate credits:

(use if needed)

1. If riparian buffers or wetland restoration are planned:
Total acres of BMP:² acres

2. If streambank restoration is planned:
Total feet of streambank to be restored: ft

EOS Nitrogen Reductions from BMP Implementation: lbs/yr

THIS SECTION CAN BE SKIPPED IF PLANNED NITROGEN REDUCTION IS the ONLY BMP OF INTEREST

1. BMPs listed are only those that have an approved nitrogen reduction efficiency by the Chesapeake Bay Model. If a practice is not listed above then the submitting entity must determine their own acceptable calculation, which can be done in conjunction with PA DEP. Contact PA DEP Water Planning Office for more specific information.
2. This calculation assumes that all BMPs are implemented together on the same field (or pasture). If cropland and/or pasture BMPs are implemented in separate locations then please fill out a separate Credit Calculation Form for each.
*If you plan on implementing Continuous No-till and you are currently doing conventional till (Section 3 above), then please select both "Conservation till" AND "Continuous no-till" in the drop down boxes to receive full N reduction credits.

Section 8 below calculates the total number of possible credits generated from the above management practices. The "Nitrogen Reductions to Edge of Watershed Segment" is a combination of nitrogen reductions from a reduction in nitrogen application rate (Section 6), if applicable, as well as reductions from any BMPs implemented (Section 7).

8. Credit Calculation

Nitrogen Reductions to Edge of Watershed Segment: lbs/yr

Delivery Ratio:¹ (x)

Nitrogen Reductions to Chesapeake Bay: (=) lbs/yr

Credits Retired to Meet the Threshold: (x)

Total Credits Generated: (=) Credits/Year

Credits sent to DEP Reserve:² (x)

Total Credits Available to Trade (=) Credits/Year

1. The Delivery Ratio compensates for the natural attenuation, or loss, of nutrients and sediments as they travel in water. The Delivery Ratio is also known as the Delivery Factor.
2. According to the PA DEP Final Trading Policy, 10% of all credits generated will be placed in the DEP Credit Reserve. The DEP Credit Reserve contains credits set aside by the Department to address nutrient and sediment reduction failures, uncertainty, and to provide liquidity in the market.