



Improving Nutrient Management Plan Implementation by Integrating Pollution and General Liability Insurance-Based Incentives

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USDA United States Department of Agriculture

CONSERVATION ENHANCEMENT ACTIVITY **CONSERVATION STEWARDSHIP PROGRAM**
E590D

Reduce risks of nutrient losses to surface and groundwater by increasing setback awareness via precision technology

Conservation Practice 590: Nutrient Management

APPLICABLE LAND USE: Crop (annual and mixed); Crop (perennial)

RESOURCE CONCERN ADDRESSED: Water

ENHANCEMENT LIFE SPAN: 1 Year

Enhancement Description

Utilize precision technology to increase Soil/Groundwater Setbacks & Associated Application Rate Restrictions (IGSBAARR) implementation during nutrient application by providing precise, real-time location information (geo-located) in the field to the equipment operator. While operating nutrient application equipment, the operator's location is continuously updated and displayed on an integrated, in-cab or add-on GPS-enabled device visible to the operator at all times to reduce the risk of nutrient application in setback and/or sensitive areas. This allows the equipment operator to manually turn off or steer equipment to avoid applying nutrients in setback or sensitive areas. Done properly this helps to protect surface and ground water resources.

Criteria

- Implementation of this enhancement requires the use of components of precision agriculture technologies for nutrient management.
- Prior or current documentation of implementation of a nutrient management meeting all NRCS Conservation Practice (CPS 590) general criteria and additional criteria to minimize agricultural nonpoint source pollution of surface and groundwater.

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NRA Libro de trabajo para aplicadores de estiércol
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Project Summary and Main Impacts

This Conservation Innovation Grant (CIG) project's goal was to improve nutrient management plan (NMP) implementation by (a) expanding a voluntary, market-based incentive and third-party verification program to additional states and to more diverse livestock/manure types, (b) increasing the knowledge of proper NMP implementation by those who are applying manure and (c) developing NRCS conservation practice(s) to improve NMP implementation. We successfully expanded the eligibility for the market-based incentive/third-party verification program to the lower 48 states, created and implemented a suite of educational materials and training for both professional manure applicators and farmers who apply their own manure, and pilot tested during field days innovative technologies that became components of the project's Conservation Stewardship Program (CSP) Conservation Enhancement Activity E590D: *Utilizing precision technology to increase setback awareness/implementation during nutrient application*, which is now available nationwide.

Project Background and Rationale

While NMPs have been around since the early 1990s, implementation (and verification of proper implementation) of them has been a challenge. Unlike physical conservation practices, where: (a) yards of soil moved to create a waterway can be measured, (b) plant species can be identified and counted, or (c) the physical impact of a resource concern is clearly visible, manure and fertilizer rates cannot be measured after application, and it is impossible to verify the application followed the setbacks after incorporation took place.

With NMPs, we rely on the farmer, their employees, and the custom fertilizer or manure applicator to follow the plan. Yet each of these groups has a long-term history of exceeding the recommended rates, either to insure against environmental nutrient losses that could negatively affect yield, to avoid the negative impression of a field that is not as green or healthy as neighboring ones, or as a way to reduce costs by applying manure to as few fields as possible. This combination provides a powerful disincentive for proper NMP implementation.

For-hire manure applicators, in particular, have been a barrier to NMP implementation. They apply the majority of the livestock manure (greater than 60 percent of the dairy manure in Wisconsin, and less but still a large percentage in Minnesota, Iowa, and other livestock states), and there is a significant efficiency incentive for them to apply high rates on the fewest fields and acres, and to fields closest to manure storage. Changing to lower rates mean higher equipment speeds and more acres covered (resulting in greater wear and tear on equipment), additional breakdown/setup downtime between fields, and the additional expense of moving manure farther distances. Other factors, such as state/local regulations and seasonal application restrictions have reduced the number of days available for application. Competition for employees has increased turnover, necessitating continual training of new staff.

Here were our goals for this project:

- Integrate and expand the Wisconsin market-based incentive program to additional states (eventually nationwide), providing a significant, private-sector financial incentive to train staff, prevent accidental manure spills, and improve NMP implementation.

- Provide easily accessible education to for-hire manure applicators, including classroom, field, and online training, creating a model other states could adapt to their state’s 590 standard and resource concerns.
- Pilot test and evaluate new technologies that could be integrated into conservation practices that could improve NMP implementation and recordkeeping and reduce human error in implementation.

Methods

Each of the goals required a different implementation strategy. Our four-state team (Georgia, North Dakota, Oklahoma, and Wisconsin (lead)) met early in the project, reviewed goals/funding, and moved forward with a multi-modal strategy.

Market-based incentives

In the first few months of the project, we met with insurance industry representatives and nationwide agreements were negotiated that would allow for expansion of the market-based incentives. Manure applicators (expanded to livestock producers later in the project) are eligible for, at minimum, a 7-percent premium discount if they document employee training on nutrient management, spill response, calibration, setbacks, and safety; implement a safety monitoring program; and provide documentation. The insurance industry completes an independent (3rd party) verification of participants (at no cost), verifying that all standards are met. If standards are not met, the participant is given an opportunity to rectify the problem(s). If they choose not to comply, they lose the premium discount. Participating manure applicators and farmers can earn larger discounts by voluntarily implementing additional best management practices (BMPs) and standards.

Since most insurance companies have internal processes to create premium reductions when risk-reduction practices are implemented, participants could either work with the insurance carriers that were part of the program or reach out to other companies and negotiate with them. We provided this information and checklists to any farmer or manure applicator who chose to go this route.

Education and training

We first developed “learner personas” (i.e., general descriptions of the types of people taking the course) to ensure we fully understood the motivations, skill levels, and needs of the for-hire manure applicators applying liquid manure (dairy, swine), dry solid manure (poultry) and wet solid manure (beef, smaller dairies). These personas were the basis for both the online curriculum and the in-person trainings being held in each state.

Together and as in-state teams, we developed, updated, and delivered in-person trainings to for-hire manure applicators in all four states. In addition to the in-person classroom training, we also

- Responded to the requests from famers, and in the third year, expanded the project’s reach, piloting with larger livestock operations who apply their own manure. This continued into years four and five.

- At the request of participating farmers, created a Spanish-language version of the remote training used in Wisconsin during the Covid pandemic, piloted, and recorded in 2020. The Wisconsin workbook and checklists were also translated into Spanish.
- Included a field component to the in-person trainings in Oklahoma and North Dakota—live calibration and equipment demonstrations.
- Integrated evaluations were deployed at each training, and the feedback from manure applicators and farmers was used to modify the training.

A completely online, self-paced version of the training was developed for each of the manure types and made available in each of the partner states. The online curriculum was designed and implemented in a SCORM-compatible (exportable) modular style, allowing states to use our Learning Management System or move it onto their own. State-specific modules can easily be added to expand the training.

A non-partner state, Michigan, copied our CIG approach, and we worked extensively with them (meeting the CIG program goal of creating a program that can be replicated) as they used our materials as a foundation to create their own, state-specific online training and market based program in 2020. This included developing relationships with the insurance industry in the state, negotiating program requirements, inspection schedules and premium discounts, and adapting the liquid curriculum in their proprietary online system.

The multi-state, for-hire applicator advisory team provided feedback throughout the development and piloting process, to ensure that the content was relevant to the audience and addressed their concerns.

Our original plan was to evaluate our participants and EQIP-eligible producers who worked with participating manure applicators. This evaluation approach had been discussed with a few applicators prior to the project, and they were willing to share customer data. During the project, when we approached the applicators about providing customer information after the training, they were unwilling to do so for privacy reasons. Working with our NRCS CIG liaison, we revised our strategy to focus the evaluation impact on the applicator employees and the business owners of the manure application firms (who, working daily with the trained applicators, would be in a very good position to judge how the training affected 590 implementation).

CSP Enhancements

These enhancements were originally titled “Advanced Nutrient Management Scenarios” (in the original proposal) we renamed early in the project. To develop these enhancements, we pulled together an advisory team of NRCS state office staff, TSPs, and university experts to discuss and identify common barriers to NMP implementation and documentation. Based on this group’s priorities, innovative technologies were identified and pilot tested/demonstrated either at the North American Manure Expo or at a field day. Working with NRCS state office staff from Wisconsin, Michigan, and Minnesota, feasibility, technology, and cost estimates for the first enhancement (E590D) were moved forward through the approval process in 2021.

Results

Market-based Incentives

More than 40 for hire manure applicator firms and farmers from the 4 states participated in the training; took part in the third-party auditing of procedures, records, and calibration; and earned market-based incentives. The insurance industry representatives noted that, depending on their participation level, premium savings ranged from \$500 to more than \$11,500 annually. Total premium savings for the target states exceeded \$100,000 annually. Total savings over the project exceed \$500,000. Seventeen additional for-hire applicators and farmers from Minnesota and Indiana are working with our insurance agency contacts to earn premium discounts by going above and beyond the mandatory state-agency licensing and training program. We do not have a way to track or document applicators and farmers who worked directly with their own insurance providers to implement their own insurance premium discounts and third-party audits outside of our program.

Education and training

More than 400 unique manure applicators representing 75 manure application firms and farms participated in classroom (in-person and remote) sessions in Wisconsin and North Dakota. Total participation was 1,090 applicator employees/farmers over 4 years, with more than 60 percent serving the primary watersheds and target areas outlined in the original proposal. Four field days were held in Oklahoma and Wisconsin, with a total attendance of 270 applicators, farmers, and agency staff. Field days demonstrated CSP enhancement technology and equipment calibration. Around 40 percent of field day attendees apply manure in the project's target watersheds.

A 6-month follow-up survey of the business owners showed the following:

- 85% of trained employees improved their ability to implement the NMP.
- 85% were better able to prevent an accidental manure spill.
- 77% were better able to follow setbacks and 73% were better able to read spreading setback maps.
- 62% were more effective at following the farmer's NMP.

A similar 6-month post-training survey of the applicator employees and farmers showed the following:

- 87% felt their ability to implement an NMP had changed.
- More than 70% felt very or quite confident explaining each of the following to the farmer/landowner:
 - How to decrease the risk of manure runoff (85%)
 - Setback maps (75%)
 - How to follow an NMP (74%)
- The largest knowledge changes (confidence explaining the concept to the farmer/landowner) reported were
 - Explaining equipment calibration (2.35/5)
 - Setback rules (2.04/5)
 - How to follow an NMP (2.02/5).

CSP Enhancements

Seven innovative technologies were demonstrated at the Wisconsin field day in 2019 or at the North American Manure Expo in 2020, all of which are included in one or both of the drafted enhancements. The CSP Conservation Enhancement Activity *Utilizing precision technology to increase setback awareness/implementation during nutrient application* (E590D) uses precision agriculture to show the manure or fertilizer applicator where they are in the field in relation to 590 setbacks and restrictions. By knowing their exact location rather than just guessing at it, applicators can make real-time decisions and adjustments to their equipment to avoid spreading in sensitive areas. The result is more accurate application in intended areas and reduced application in unintended areas. The enhancement is designed to work both with the latest tractors and technology as well as >40-year-old tractors and box-style manure spreaders commonly found on smaller and limited resource operations.

Challenges

The two primary challenges faced by the project were manure applicator hesitation/privacy concerns and the effects of the Covid pandemic. Pre-award work with potential participants in all four states indicated a strong willingness to participate and provide contact information and direct connection to EQIP-eligible producers. Project partners worked hard to create trust and build relationships, but when the request for contact information was made, the manure applicators were not willing to provide it. The primary reasons given related to the growing distrust of government agencies and concern over data privacy. In consultation with our NRCS Liaison, we pivoted to measuring impact with the business owners rather than the individual farmers, and that approach was successful, as documented in the evaluations.

The Covid pandemic impacted our ability to do in-person training and conduct in-person field days. In-person training was replaced with remote sessions when possible. Participants strongly preferred in-person training over self-paced online learning (which contradicted what we were told during the needs assessment for the project), and this became evident prior to the pandemic, but became even stronger during it. The pandemic forced the cancellation of multiple field days, and pivoted some (but not all) training to remote delivery. Rural broadband ability was a factor in how many individuals were able to participate.

Applicators and farmers in Wisconsin were more willing to participate in remote training than other partner states. Remote training was delivered to farmers and applicators simultaneously in small groups on farms/individual business's facilities rather than in large in-person meeting rooms. Post-event surveys with those who did both in-person (pre-pandemic) and remote sessions during the pandemic showed that 50 percent felt they learned just as much over a remote connection, 25 percent felt they learned more, 17 percent felt they learned less, and only 8 percent felt they learned much less.

Internally, staff turnover delayed the development of the online courses, and our project partner from the University of Georgia left the project when their lead's funding was eliminated. This departure limited participation by applicators and farmers in Georgia.

Summary of Outputs

This project's outputs are divided into five categories: (1) *NRCS conservation practices* and companion materials, (2) *market-based incentives/3rd party verification*, (3) *safety checklists*, (4) *manure applicator educational resources* (online, in-class workbooks, training videos), and (5) *fact sheets* that support nutrient management implementation

NRCS conservation practices

Two CSP enhancements for 590 were drafted as part of this project after pilot testing of the components during field events. [CSP Conservation Enhancement Activity Utilizing precision technology to increase setback awareness/implementation during nutrient application. \(E 590D\)](#) (dated April 2021) was developed as part of this project, and was designed to help eliminate common human error in nutrient applications. A companion explanation presentation, [CSP Enhancement: Benefits and how it works \(CSP 590-D\)](#) (dated August 16, 2021) was made available nationwide in fiscal year 2022. Post-project work continues to develop the other enhancement: *Utilizing precision technology to increase setback implementation by utilizing automated setback controls (E590-X)*.

Market-based incentives/3rd party verification

A goal of the project was to expand the market-based incentives for manure applicators nationwide. While we worked with a small subset of insurance carriers to achieve discount eligibility in the lower 48 states, the concepts and principles (manure applicator/farmer implements safety protocols, equipment calibration and inspections, third-party audit) are intentionally not proprietary, and can be used by any insurance carrier. Any interested manure applicator or farmer can work directly with their insurance agent and the carrier's risk-reduction specialists/underwriters to copy the program we have in place.

Safety checklists

In partnership with the insurance industry and university safety experts, a series of six safety checklists were developed (over the road and in-field for liquid, wet solid, and dry manures) in both English and Spanish.

<u>Wet Solid Manure Edge of Field</u>	<u>Esparcimiento en el campo de estiércol sólido seco</u>
<u>Dry Solid Manure field spreading</u>	<u>Estiércol sólido seco en carretera</u>
<u>Over the Road Dry Solid Manure</u>	<u>Estiércol sólido húmedo en el borde del campo</u>
<u>Over the Road Wet Solid Manure</u>	<u>Estiércol sólido húmedo en carretera</u>
<u>Liquid Manure Field Spreading</u>	<u>Esparcimiento en el campo de estiércol líquido</u>
<u>Liquid Manure Over the Road</u>	<u>Estiércol líquido en carretera</u>

Manure applicator educational resources

Registration information for the liquid, wet solid and dry manure training ([Self-Paced Manure Applicator Training](#)) is now open to all. Forty-two training videos were developed and are included in the course, but can also be used as stand-alone trainings ([Manure Applicator Training Course Videos & Audio](#)). For Wisconsin, an in-person workbook was developed for training (available as a model for other states) in English ([Manure Applicator's Workbook](#)) and Spanish ([Libro de trabajo para aplicadores de estiércol](#)). Non-partner state Michigan adapted the program in 2020, developing both a market based program and online training. Information on their version can be found [at this website](#).

Fact sheets

Partner states developed five fact sheets or resources to be used either with the training or as stand-alone materials. These included:

- [Solid Manure Sampling for Nutrient Management Planning](#)
- [Manure Spreader Calibration](#)
- [Manure Spills: What You Need to Know and Environmental Consequences](#)
- [North Dakota Manure Application Setbacks](#)
- [Poultry Litter Spreader Truck Operation and Calibration](#)

Impact

Proper implementation of NMPs is essential to meet both nitrogen and phosphorus surface water quality goals. NMPs rely on a variety of people to implement them: farmers and professional manure applicators and custom fertilizer applicators. Our three-pronged approach (a market-based incentive, education, and the CSP enhancement designed to reduce potential human error) is an effective model not only for nutrient management, but potentially other conservation practices as well. By working with everyone who touches the land, these motivations and technologies can carry over to the other acreage they affect, not just those acres under a 590 plan. Previous work has shown that the combination of education and market-based incentives greatly reduces manure spills and runoff incidents.

- The market-based incentives saved farmers and manure applicators more than \$500,000 over 5 years while providing a third-party audit of their equipment, spill response plan, and equipment calibration. The non-proprietary market based incentives are available in the lower 48 states. This will continue after the project ends.
- More than 400 unique employees from 75 for-hire manure application firms and farms received training to improve their ability to implement nutrient management plans. Evaluation (after the training and six months later) showed significant improvements in participants' ability to more accurately implement NMPs.
- A new 590 EQIP enhancement was piloted, improved, and is now available nationwide.

Potential Next Steps

Looking forward, there are a number of steps that NRCS may want to consider to capitalize on this project's deliverables and impact. These include:

- Expand the market-based incentive concept to other conservation practices and conservation farming systems.
- Evaluate both the effectiveness and impact of the implementation of the project's CSP Enhancement (590D) on 590 implementation.

- Encourage the partner states to move forward on the completion, finalization, and implementation of the project's other CSP enhancement: E590X – Reducing risk of nutrient losses to surface/groundwater via precision technology, application diversion and automating setback control.
- Prioritize states who could implement one or more of the online manure applicator training courses, with participating states committing to developing a state-specific module that addresses that state's 590 and state-specific resource concerns.

Acknowledgements

The project team would like to acknowledge the efforts of the many manure applicators, insurance company staff, manure equipment industry staff, and educators (all too numerous to mention here) who devoted many hours to ensure the success of this project.

Cover Photos (Left to right, top to bottom): Manure Applicator Jordon Anaya installing E590D maps on the tablets his crew uses for manure application. Screen image showing vehicle location (white icon) in relation to 590 well setbacks (pink/red circles), shallow water table soils (green dots) and water setbacks (blue lines). Front page of CSP Conservation Enhancement Activity 590D developed by this project. Field demonstration of automated manure application shutoff technology (application resumed after the equipment passed the waterway). Cover photo for the Spanish language version of the Wisconsin Applicator Workbook 2020. Photos: Kevin Erb, University of Wisconsin–Madison Division of Extension.