Nutrient Management Plans
How closely do farmers follow them?

By Tanner Ehmke
Crops & Soils magazine contributing writer
Nutrient management plans aren’t exactly high on a farmer’s fun list when it comes to conservation practices on the farm. In fact, writing and implementing a nutrient management plan ranks second only to installing riparian buffers as farmer’s least favorite conservation practice, according to a recent study by the National Institute of Food and Agriculture.

It might not come as a surprise then, that nutrient management plans, which are required of concentrated animal feeding operations (CAFOs) under the Clean Water Act and enforced by the USEPA, are not always followed to the letter. Even crop farmers who participate in conservation programs with the Natural Resources Conservation Service (NRCS) struggle with full implementation.

Linda Prokopy, associate professor of natural resources planning at Purdue University, who recently surveyed 1,320 Indiana farmers on nutrient management plans in a study funded by the Corn and Soybean Checkoff, discovered that only a handful of farmers with a plan reported to have fully implemented them.

“We asked the question on the survey, ‘Do you agree that you’re following all of the guidelines in the nutrient management plan?’ And only 27% of the people strongly agreed that they’re following all of the guidelines,” she says. “I interpret that only 27% of the people were willing to say, ‘Yes, I am doing every single thing in my plan.”

The reasons for the lack of compliance are complex and widespread, says Deanna Osmond, soil scientist at North Carolina State University who studies farmers’ implementation of nutrient management plans, conservation practices, and water quality protection.

Osmond recently published an article in the Journal of Environmental Quality analyzing nutrient management decision making at the farmer level. She found that farmers generally did not fully apply nutrient management plans or follow

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1. See https://dl.sciencesocieties.org/publications/jeq/articles/0/0/jeq2014.02.0091

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basic soil test recommendations even when they had them. Farmers often ignored university recommendations on fertilizer rates.

“We found that nutrient management was one of the most disliked practices and was frequently abandoned for several reasons,” Osmond says. “Further, nutrient management was seen as a crop production tool rather than a conservation tool.”

This is cause for concern, she notes, given that nutrient management is the first line of defense in reducing agricultural nonpoint source pollution. Nutrient runoff issues in the Chesapeake Bay, Lake Erie, and the Gulf of Mexico are notable examples capturing public attention.

But while farmers typically understand and appreciate the need to responsibly use fertilizer and protect the environment, she says, writing and implementing plans are easier said than done due to various complications.

Osmond points to time constraints, weather, fertilizer shortages during ideal application times, complexity of plans, lack of familiarity with technical and financial support opportunities, and education, including interpretation or explanation of program requirements as problems that may limit implementation. Resolving the issues that prohibit full implementation of plans, she says, will take an industry-wide effort.

A matrix of complications

Livestock producers required by law to write nutrient management plans might have the most difficult job of all when it comes to implementing their plan with an unpredictable source like manure, says John Lory, environmental nutrient management specialist at the University of Missouri.

Nitrogen and phosphorus, the two nutrients of most concern with USEPA when it comes to nutrient runoff, can vary significantly in animal waste—creating a point of frustration for farmers who have to match manure tests with soil tests in the field, crop rotations, and yield goals.

“On farms where there’s animal manure, that process is more complicated, and you’re working with a material that’s less understood by farmers. There’s no guaranteed analysis with that material. You have to go figure out what’s in it,” Lory explains. “And it’s also a material that’s less obvious when and how much of it’s going to be available. On top of that, you’re also dealing with a material that’s not necessarily a balanced fertilizer. So technically, when we talk about nutrient management planning, we’re usually talking about farmers who have manure just because that’s where there’s more obvious challenges to get the right rate of nutrients on a field.”

Mandy Fox, CCA at Fox-Z Consulting in Hays, KS, who advises livestock operators in Kansas, Colorado, and Oklahoma in writing and implementing plans, notes that it is especially difficult to implement a long-term plan while dealing with severe drought conditions that force producers to deviate from their initial plans and alter their cropping and fertility decisions.

“The plan is written for five years, but it evolves during that five-year cycle
because you’re constantly taking soil samples every year and readjusting,” Fox explains. “If I asked you what you’re going to plant on a particular field five years from now, depending on what the weather does or what the market does, that’s going to change. We write the plan with some assumptions for that five-year cycle, but we have to adjust. You accommodate the current soil test, the waste testing, and cropping plan.”

For farmers in southern states like North Carolina where the average field size is 12 acres, writing a plan can be overwhelming compared with Midwest farmers who often enjoy farming bigger tracts of land across fewer fields, adds Osmond.

Implementing a plan for every small field no matter the size, she says, can be incredibly time consuming for the farmer.

“If a big producer has 3,000 acres and your field size is 12 acres, that’s 250 fields,” Osmond notes. “It may be difficult to change your nutrient settings for every single field during a time crunch because each field might require a different nutrient plan. Many farmers are stretched to apply their nutrients and plant during very short application windows.”

In the Midwest, farmers may also struggle with fertilizer supply shortfalls in the springtime, which is the most ideal season for fertilizer application, Osmond says. Farmers therefore often apply fertilizer in the fall to spread out supply and the workload, but leaving the fertilizer vulnerable to runoff and leaching over the winter months.

“In some locations, there isn’t sufficient capacity at the retail level to move all the nitrogen in the spring,” Osmond explains. “Structural changes may need to occur at the retail level to accommodate better timing of nitrogen.”

Further complicating implementation, a logjam of paperwork can also be a concern for the farmer, notes Fox, who helps her clients navigate the paperwork-intensive plan. Fox compiles her clients’ plans into a three-ring binder, which is then condensed into one sheet of paper that details individual fields, application rates, source of nutrients like wastewater versus solid manure, and the cropping schedule.

Smaller operators may go it alone without a CCA to advise them in implementing plans, Fox adds.

“Some of the bigger operations have elected to hire a consultant because to them it’s like hiring a nutritionist or
hiring a veterinarian. It’s part of doing business. It’s something we can give guidance on,” she says. “Some of the smaller operators tend to try to do it on their own.”

Fertilizer as crop insurance

Wide distrust of university-recommended fertilizer rates is another problem unto itself, Osmond found in her study.

Farmers are typically risk averse and prefer to hedge by over-applying fertilizer to ensure sufficient crop nutrients are available should optimum growing conditions develop later in the season. Surveys of farmers around the country reveal similar discouraging news that university guidelines on fertility rates are often ignored despite educational seminars from university extension.

The farmer’s source of information also matters, Osmond says.

“Farmers generally utilize information provided through self-experimentation, talking to their neighbors, and, in some cases, from their fertilizer dealers,” she says. “University recommendations may or may not be part of this information stream, and the recommendations may differ depending on who’s giving advice.”

Lory agrees that risk aversion is a common problem when it comes to farmers over-applying fertilizer and not clearly understanding the consequences. Education and technology can help solve that problem.

“There are way more risks from a financial bottom line from under-applying a nutrient than there is by over-shooting a little bit,” he says. “That said, we’re also giving farmers tools that will give them a lot more ability to apply closer to the correct rate and know with variable-rate applicators that there are different parts of the field that respond differently to nitrogen. So as we understand that better, we can do a better job of application rate.”

In a recent survey of Michigan farmers, high corn prices were also cited as a reason to increase nitrogen rates above recommended rates. The recent change to low corn prices could be an opportunity to help producers learn to control fertilizer costs.

Jeff Polenske, CCA at Tilth Agronomy in Appleton, WI, who has helped farmers write nutrient management plans since 1989, says his farmer-clients are willing to shift to a new method of applying only recommended rates if they see the benefits over time with reduced fertilizer bills and no penalty on yield.

“There are times they can be apprehensive because maybe they don’t feel that there’s enough fertilizer in the field,” Polenske says. “This is their livelihood and they depend on that, and they can get a little nervous if there’s not enough going on that field. But over time, they can change. They’ll try it on a field or two and see that it works. Then the next year or year after, they’re doing it on all of them…. It takes a little bit of time, but eventually they buy into it and it works quite well.”

Improving adoption and compliance

Size matters when it comes to adopting nutrient management plans, Prokopy says. Bigger farmers tend to have a greater degree of compliance than smaller producers.

“Of the population that we surveyed in Indiana, the very large farms as defined by the USDA Economic Research Service with more than 1,000 acres are significantly more likely to be using [nutrient management plans] than the smaller farms,” Prokopy says.

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According to Prokopy’s study, 48% of very large farms use nutrient management plans while 32% of large farms and 18% of small farms have plans.

The challenge is to reach smaller operators and help them make sense of manure tests, what they mean, and how to use that information, Lory says.

Lack of compliance with a nutrient management plan might also be an issue of education, he says.

“We’ve been trying to get farmers to write nutrient management plans probably now for 12 to 15 years,” Lory says. “But now when people have a plan, do they know what to do with it?”

Lory is developing tools on the web to help farmers with implementing their plans. For farmers without a consultant, a web tool could help individuals interpret manure and soil tests and navigate paperwork.

For producers who can hire CCAs, making their plans simple and easy to follow is important, Osmond says.

“When CCAs, agencies, and extension personnel develop nutrient management plans, they need to be simple, understandable, and doable,” Osmond says. “Some nutrient management plans for animal waste operators are pages long. Farmers are busy and they wear many hats, so management needs to be easy.”

Teaching the fundamentals of the 4Rs of nutrient stewardship—the right fertilizer source at the right rate, at the right time, and in the right place—can help producers simply the concept of nutrient management for the farmer and further help with implementation, Lory says.

“The 4Rs are basically a planning process that’s boiled down into a short logo, so everybody’s down with the planning,” he says.

Detailed and organized record keeping of nutrient management is especially helpful with building a better understanding of nutrient management on the farm, Lory says. With proper records in place, CCAs can help their producer-clients understand the financial rewards of writing a plan.

“You’re trying to extract the most financial value out of those nutrients, and the farmer recognizes that record keeping is the foundation of what the next plan is going to be,” he says. “It may not be the perfect plan, but if he manages to keep records, he’s starting into a conversation that’s going to lead to an understanding of nutrients on his farm, and ultimately, to a better plan for his operation.”

Helping producers use variable-rate technologies on their operation can aid in successful implementation of plans and make the delivery of nutrients faster, easier, and more responsive to changes in crop rotations, soil nutrient levels, or weather, he adds.

“There are some great tools out there to deal with some of the uncertainty, especially with manure applications,” Lory points out. “Using sensors to sidedress N on fields to be able to get a variable rate based on corn color across the field will help account for some of the variability that’s in the manure. That’s a vision that we’ve that we had probably 15 years ago, and it’s great to see we’re at a point where that technology is out there. All these different technologies as they emerge offer new opportunities to do a better job with not only manure, but all fertilizers.”

Cost share through NRCS’s Conservation Stewardship Program (CSP) has also been successful at introducing farmers to the concept of nutrient management plans if they do not manage livestock waste on their farm. With CSP, the cost of hiring a CCA to help implement a plan is shared with the producer, Polenske points out.

“My farms are in various programs through NRCS, the EQIP program, or a number of other ones. Probably the most used one is the CSP program,” he says. “A lot of my farmers are involved in that who care about conservation and want to preserve their farm and do their best to protect the environment, and they’re being paid pretty well for that. [CSP] pays for a lot of my scouting services and the nutrient management plan also. It’s gone over quite well.”
The agriculture and fertilizer industries, meanwhile, need to have a consistent voice about nutrient management, Osmond stresses. Because progress takes considerable and sustained discussions and demonstrations with farmers to show the value of a practice, anything that simplifies correct nutrient application will help with adoption, she says.

“Industry, agencies, and educators all need to give the same message to farmers,” Osmond says. “Substantial change and improvement in the design and marketing of programs would facilitate greater adoption. Everyone—farmers, retailers, and agency and university personnel—must all work together to increase nutrient management use.”

Significant investment in soil testing and outreach to demonstrate the effectiveness and value of nutrient management will be needed in the future, she says, stressing the importance of CCAs with science-based implementation.

Lory agrees more outreach is needed to make nutrient management plans more widely adopted and effective.

“All farmers are going to benefit by taking advantage of knowing more about how their crops are responding, keeping better records about the types of soils and response to fertilizer, testing out how well fertilizer practices are working, and taking advantage of new technologies,” Lory concludes. “That is going to be part of our future. There are a lot of benefits to farmers to their bottom line, but we’ll also be able to tell the positive story of agriculture and how we’re good stewards of the resources we have.”

Further resources


**NRCS Comprehensive Nutrient Management Plans:** [www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/?cid=nrcs143_014041](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/?cid=nrcs143_014041)

**University of Missouri Nutrient Management Tracker:** [http://nmplanner.missouri.edu/software/nmtracker.asp](http://nmplanner.missouri.edu/software/nmtracker.asp)

**Purdue University Manure Management Planner:** [www.purdue.edu/agsoftware/mmp/](http://www.purdue.edu/agsoftware/mmp/)

Brian Johnson (middle), a fourth-generation farmer, and his dad, Alan (left), operate a diversified no-till row crop and cow/calf operation near Frankfort, SD. They participate in NRCS’s Conservation Stewardship Program (CSP). The CSP can pay for the cost of writing a nutrient management plan. On the right is Shane Jordan, NRCS District Conservationist.