

The 4Rs of nutrient management—applying the right fertilizer source at the right rate at the right time and in the right place—easily summarize the increasingly complex fertility decisions that have to be made by CCAs and their farmer clients. In this issue, we take a look at how this concept is being implemented in the field.

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Top image courtesy of iStockphoto. Middle two images courtesy of AgLeader. Bottom image courtesy of Bob Nichols (USDA-NRCS).

Whether you know it or not, you've been a steward of the 4Rs of nutrient management if you've promoted or practiced the benefits of greater fertility efficiency in the field.

The 4Rs are simple: Apply the *right* fertilizer source at the *right* rate at the *right* time and in the *right* place. Promoted by The Fertilizer Institute, The Canadian Fertilizer Institute, The International Plant Nutrition Institute, and the International Fertilizer Industry Association to encourage better fertility management among farmers and CCAs, the 4Rs are more than just a catchy title. They are the commonsense rules that are the foundation for a high efficiency, high yielding, and environmentally sensitive crop producer keen on maintaining soil health while managing costs.

Farmers and their CCAs have been quick to grasp the 4Rs, too, says Brandon McClure, CCA with Morral Companies in Morral, OH.

"It's spread really fast," says McClure, who works one-on-one with farmers to implement the 4Rs on their operations. "Our company started working with the 4Rs two years ago, and it's just taken off like crazy."

At the farmer level, the 4Rs easily summarize the increasingly complex decisions that have to be made when practicing nutrient management, says Harold Reetz, a veteran CCA with Reetz Agronomics in Monticello, IL, and former International CCA chairman. "They're interconnected," he says. "It's easily depicted as four puzzle pieces in the middle of a circle (Fig. 1, next page). They all link together."

The 4Rs have also reached far beyond those who employ it in the field, Reetz adds, encompassing government agencies, environmental groups and universities around the world.

And, in an age of increasing government regulations amidst growing concern of ground water contamination and the Hypoxic Zone in the Gulf of Mexico, the 4Rs illustrate to the public and the officials they vote for that agriculture can manage fertility on its own with individual growers able to tailor a system that works best on their particular operation.

"I always feel like we're better off if we don't legislate fertilizer management," Reetz says. "It should be done on

Image courtesy of Jason Ellsworth



4R nutrient management
Right **source**. Right **rate**. Right **time**. Right **place**.

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the basis of science instead of politics. One of our big objectives is to avoid getting into legislative controls. Hopefully science, the applications of science, and using the 4Rs prove we can manage our nutrients according to the best practices available. And in the process, increase profits, increase yields, and reduce environmental impacts. That should be a win-win-win for everybody.”

The first right step—information

Getting the right information is the beginning of bringing the other pieces of the puzzle together, Reetz explains. That starts with soil sampling—the critical first step that enables farmers and their CCAs to make the right prescriptions to the field, like taking a patient’s temperature before prescribing a medication.

For farmers like Bruce Favinger, a corn and soybean farmer near Minden, NE, soil sampling has long been an essential practice on his farm for greater nutrient efficiency. By quantifying the fertility needs for every acre of his farm, Favinger and his CCA, Ty Fickenscher with Cooperative Producers, Inc., in Wilcox, NE, have the knowledge to make the most accurate decisions possible when managing his multi-faceted fertility program throughout the growing season.

“We do variable-rate soil sampling on every acre and then do variable-rate fertilizer application,” Favinger says. “We do split applications. We put some on pre-plant, we put some on with the planter. We sidedress some fertilizer, and we do use some chemigation, if it’s necessary.”

Right source

When tailoring a fertility program to each individual farmer client, McClure stresses that the right source may not work for everybody.

“Choosing the right product is obviously key,” McClure says. “We don’t sell a particular program, per se, or bundle things together just for sales efforts. At ground level, we have to make sure that we’re just watching very closely the nutrients that we’re using. We judge nutrient needs strictly field by field. So product wise, there’s always a reason.”

Selecting which fertilizer source to use begins with evaluating which nutrients are actually required for optimal plant growth, determined by soil sampling or tissue testing, say experts at the International Plant Nutrition Institute.

But the work doesn’t stop there. Soil conditions, environmental risks, product price and availability, fertilizer delivery issues, and economic constraints

The 4R Nutrient Stewardship Strategy

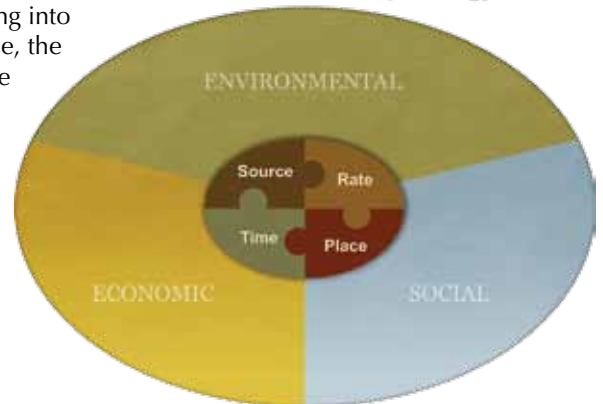


Fig. 1. The 4R nutrient stewardship concept defines the right source, rate, time, and place for fertilizer application as those producing the economic, social, and environmental outcomes desired by all stakeholders to the plant ecosystem.

Images from top to bottom: iStockphoto, Michael Russelle, Dan Schaefer, and Exactrix Global Systems.

also require thoughtful consideration when evaluating which fertilizer source is most appropriate.

Even proximity to urban development matters, McClure adds. Since manure application is visual and has an obvious odor noticed by residential neighbors, other fertilizer alternatives might have to be considered.

Right rate

While the 4Rs work as a system, Favinger feels that rate has a special place in the puzzle.

"We've always felt the right rate was the most important thing," Favinger says, stressing the importance of variable-rate application, which reduces the risk of over- or under-applying a nutrient.

Newer, more sophisticated technologies on the market have helped Favinger achieve even greater efficiencies with fertilizer use with precision control over rate.

"With the electronics that are available today with GPS and autosteer, it's a lot easier to do variable rate now than it used to be," he says. "We used to try to do it by manually setting up two to three zones in fields when we needed some different application rates. Now, it can all be done automatically with computers. It's just progressed over time. It's a much easier thing to do now."

Rate can now even be adjusted on the go and in-season by using sensors, processors, and controllers mounted on the tractor or applica-

tor, Reetz adds. That innovation, which Reetz has seen develop over the years since its inception, has helped farmers today gain even more control on the amount of nutrients the crop is receiving. "It's a very significant change over what we had 20 years ago," he says.

New innovations in the realm of aerial photography and satellite imagery may also give farmers more information on application rate, Reetz notes. Some experimenters today, he adds, are even working with small model airplanes and helicopters equipped with cameras to aid in variable application rates.

Right time

Pulling the trigger on a fertilizer application at the right moment is also crucial for optimizing a fertilizer's contribution to the plant, says Dan Schaefer, Director of Nutrient Stewardship at the Illinois Council on Best Management Practices.

With a split application of fertilizer where the farmer applies fertilizer at different points of the year and delivers nutrients when the plant needs them the most, less fertilizer is lost to leaching and more is utilized by the plant.

"To minimize producer risk, we put part of it on in the fall—maybe 50% of our nitrogen with a stabilizer," Schaefer advises. "In the spring for pre-plant, use a low rate of UAN stabilized. And then, we go in in-crop and can look back to determine if we need an in-season application by using the MRTN [maximum return to nitrogen] as the guide to our rate."

Image courtesy of Bob Nichols (USDA-NRCS)





Corn begins its rapid uptake of nitrogen at V12, Schaefer explains, with the plant having used only 20% of its total nitrogen needs prior to that point. Waiting until that key growth period to deliver nutrients to the plant, he says, optimizes plant uptake of the nutrient while minimizing loss.

Nitrogen stabilizers are a useful tool that give farmers another level of control over timing of fertilizer applications, McClure adds, particularly when contending with wet, saturated soils. With the heavy soils of his region of Ohio, he says, excessive rain in the last two years has resulted in ponding or flooding, which causes problems with nitrogen leaching and denitrification. With a stabilizer, the grower is still able to have fertilizer available to the plant early in the growing season without losing it.

“Stabilizers have increased our yield because we’re holding onto those nutrients,” he explains. “We’re not cutting back our nitrogen rates, but we’re getting all the use out of them with these products without having to use more product than necessary.”

For Fickenscher in Nebraska, timing the delivery of nutrients during the growing season via pivot fertigation has produced big results for his farmer clients.

“That’s one great thing about the application. It’s when the crop really needs it, and we have seen improved yield from doing that,” Fickenscher says.

In addition to better crop utilization, he says, in-season applications through the pivot have also reduced leaching and runoff.



Right place

Right placement of nutrients in the soil is also a key ingredient for increasing plant utilization and minimizing nutrient loss, McClure says.

But choosing where in the soil to place the fertilizer, Reetz adds, depends much on the fertilizer source you’re working with.

“If you change the product that you’re using, then you may need to change placement,” he advises. “Some have to be incorporated, some of them can be surface applied. Some need to be put on before planting, and others need to be sidedressed or topdressed.”

For example, if a farmer is used to using anhydrous ammonia, he explains, you can’t switch to topdressing without changing the product that you’re using since anhydrous can only be applied below the soil surface.

Right placement of the fertilizer also means having the right technology and using it properly, he adds.

“You adopt new technology where the needs are and where you can justify it,” Reetz says. “There are some people who buy a new piece of equipment and look for a problem to solve with it. You’ve got the wrong things driving the issue there, I think, when that happens.”

Does 4R mean high tech?

Technology undoubtedly enables farmers and their CCAs greater control over delivering nutrients to the plant to increase yield and reduce nutrient loss.

But growers can still incorporate the 4Rs even if they lack sophisticated technology or elaborate fertility programs.

“We can print [the field map] off on a paper, and they keep it in the cab with them,” McClure says. “As the farmer



Images from top to bottom: iStockphoto, Veris Technologies, Tim McCabe (USDA-NRCS), and USDA-ARS.

goes across the field, he can say, 'This 10 acres here only needs two or three thousand gallons of manure.' It's not being done automatically, but we're doing it as we go. So, you don't have to have the latest technology to start doing things right."

Reetz agrees that farmers can have access to variable-rate application even by doing things by hand. Farmers can use a color chart to judge the nitrate levels of a crop and then properly apply the nutrients. The 4R management concept, he says, fits anywhere in the world.

"Technology certainly does play a role in fertility rates. But, I think it's important to realize that it doesn't have to be just our North American broad-acre farmers," he points out. "Some of these technologies also work on the small one-hectare plots in southeast Asia, too."

The 4R future

With global commodity and fertilizer prices sure to continue rising as world food and fiber demand grows, the 4Rs will without question continue to grow in importance among farmers, Schaefer says.

"In the last several years, we've gone from \$400/acre gross margins to \$800 to \$900—even \$1,200/acre. When

you do that, your inputs go up and the chance of making a profit is there, too. So, you've got to move to an intensively managed crop rather than just throw the fertilizer out there and be done with it. It's something that farmers are really looking at hard."

The only barrier to wider adoption of the 4Rs, Schaefer believes, is education and getting the word out. That's where crop advisers come into play, he says.

McClure agrees that to help growers navigate the increasing complexities of new technologies and rising input costs, the relationship the grower has with CCAs and retailers is going to be more important than ever.

"That's who the grower ultimately is going to listen to and have a good relationship with," he says. "It sounds kind of corny, but it makes a huge difference being able to sit down and have a good working relationship with a good grower. We know what each other's plan is and what we're doing, and we can focus on what works."

Building a relationship with the farmer, he explains, opens the lines of communication, which helps the CCA better understand the farmer's specific problems and in turn helps the farmer become more open to adopting 4R principles or relevant technologies.

Image courtesy of SciMax Solutions (www.scimaxsolutions.com)





For farmers like Favinger who anticipate a more complex future in agriculture, a supportive and knowledgeable CCA will be a crucial asset for continued implementation of the 4Rs as technology changes.

“There’s so much information technology that we can’t be an expert in everything we do,” Favinger says. “We have to rely on the people and consultants to come in and help us with it.”

Information management will also be key to effective fertility programs in the future, Reetz stresses. Good record keeping ties into the new technologies with GIS, computers, and communication, he says.

On Favinger’s farm, that’s taken the form of the CPI 300 database program from Cooperative Producers, Inc., or CPI.

“With CPI, they’ve helped us with the variable-rate program called CPI 300 where we are trying to bring all this information together—the information from the yield maps, satellite imaging, seed maps. It’s just bringing the whole thing together as a system.”

To learn more about the 4R’s, see www.nutrientstewardship.com

The CPI 300 program sorts Favinger’s crop data, analyzes the information, and tells him what methods are working. It also allows him to do in-field test plots where he can try different farming methods on particular hybrids or soil types, he says.

“You can take a small block—a two- or three-acre block in the middle of the field—and change your fertilizer rate or change your seeding rate on that block, and when you come through with the yield monitors, it will tell you if what you did was an improvement, or if it stayed the same, or if it changed the yields. It’s just kind of an in-field test plot all the time,” he says. “There are so many variables, this will take us to the next step of finding what works.”

However, good old agronomic practices like soil testing won’t be replaced with technology, but new technology will enhance their value, adds Reetz. And, the 4Rs will help growers and CCAs remember the fundamentals in an increasingly complex world.

Nonetheless, he says, having a sound record-keeping system to help pull technology and information together will be instrumental for effective implementation of the 4Rs in the future, helping farmers and their advisers make better-informed crop management decisions.

“The guys who have a 20-year database in their records are better off than those who have a five year,” Reetz says. “Those who haven’t started yet better get with it.”

Growers of the future will also need as many fertilizer options as possible, Favinger adds. That means using them responsibly today to ensure their availability in the future.

“I think it’s important we use commercial fertilizers, and I think if we can act responsibly and get ahead of the game, maybe we can avoid being forced into it later,” he warns. “And, it’s just good management. If we can utilize our fertilizers to the best of our ability, it makes financial sense for us.”



Images from top to bottom: iStockphoto, AgLeader, University of Florida, and the University of Kentucky.