



Nutrient Stewardship

Reducing the Loss of Crop Nutrients to Waterways

Crop nutrients help plants grow and produce the food, fiber and fuel we need. Unfortunately they can also nourish algal blooms in waterways. We support and promote the 4R Nutrient Stewardship framework to achieve the agricultural benefits of fertilizer and reduce nutrient loss to the environment.

Mosaic wants farmers to achieve maximum plant nutrition and yield benefits from our crop nutrition products. But when crop nutrients run off farmland into a waterway, they can contribute to impaired water quality. It is in everyone's best interest that nutrients remain in the crop's root zone.

Fertilizer is a vital agricultural input and investment—one that requires agronomic knowledge and careful planning. Each harvest, nutrients are removed from the soil. Because soil fertility is not self-sustaining, these nutrients must be added back each year to ensure future crop growth.

Various sources of nutrients can load local waterways, including runoff from farmland, livestock operations and municipal wastewater. Greater

Fertilizers make it possible for farmers to grow enough food to feed the world's

7.4+ BILLION PEOPLE

UP TO 60% OF CROP YIELDS are attributed to fertilizers

concentrations of nutrients can be present in areas where soil fertility is needed for crop production, and where agriculture is a significant use of land. Nutrient losses can stimulate algal blooms in water, impacting the surrounding watersheds, environment and community.

Crop nutrients must be applied using science-based 4R Nutrient Stewardship practices to mitigate potentially negative environmental impacts stemming from improper use. Good nutrient management is possible, but best management practices differ from farm to farm. It takes testing, research, planning, measurement and collaboration to determine which nutrient management practices are most effective, adaptive and scalable.



Phosphorus, the mineral in phosphate fertilizer, is an essential mineral for all life

In plants, phosphorus supports root growth, plant development, resistance to diseases and water use efficiency—producing higher crop quality and increased yields.

The Mosaic Company is one of the world's leading producers and marketers of concentrated phosphate and potash crop nutrients. Our mission is to help the world grow the food it needs. We mine, manufacture and deliver our products to customers in key agriculture markets.



4R Nutrient Stewardship: Guided by Science and Research

Mosaic supports and promotes the innovative, science-based 4R Nutrient Stewardship framework, which helps define practices to meet the economic, environmental and social sustainability goals of a farming operation.

4R Nutrient Stewardship encompasses fertilizer best management practices to achieve specific cropping system goals, including maximizing profitability and environmental protection. To achieve those goals, the 4Rs framework incorporates the Right nutrient source, at the Right rate, at the Right time, and in the Right place.

The concept of 4R Nutrient Stewardship is simple, but implementation is knowledge-intensive and varies farm by farm. Other agronomic and conservation practices, such as tillage practices and cover crops, play a valuable role in supporting nutrient stewardship. As a result, fertilizer best management practices are most effective when combined with other agronomic and conservation practices.



The 4Rs of Nutrient Stewardship



Right Source
Matches fertilizer type to crop needs



Right Rate
Matches amount of fertilizer to crop needs



Right Time
Makes nutrients available when crops need them



Right Place
Keeps nutrients where crops can use them

Source: NutrientStewardship.com

Suggested Best Practices to Keep Phosphorus on Farmland

- ✓ **DO** soil testing to determine nutrient requirements for the next crop
- ✓ **DO** consider all nutrient sources available to the crop when deciding on how much to apply
- ✓ **DO** inject or incorporate phosphorus whenever possible
- ✓ **DO** delay application for low-lying fields that are prone to flooding until just before planting
- ✓ **DO** use cover crops to improve soil health, increase water-holding capacity and reduce surface runoff
- ✓ **DO** include starter or row phosphate fertilizer wherever practical
- ✓ **DO** schedule phosphate fertilizer applications for no-till programs as close to crop utilization as practical
- ✓ **DO** schedule phosphate fertilizer broadcast applications in conventional/reduced tillage programs for seasons when shallow tillage is possible
- ✗ **DON'T** schedule phosphate fertilizer applications just prior to heavy rainfall
- ✗ **DON'T** schedule phosphate fertilizer applications when soils are frozen or snow covered
- ✗ **DON'T** broadcast apply phosphate fertilizer near surface drains or exposed tile stand pipes; consider injection or banded application methods
- ✗ **DON'T** apply phosphate fertilizer near ditches, streams or waterways

Source: NutrientStewardship.com

Advancing Industry and Agriculture Supply Chain Efforts

At Mosaic, we think about sustainability broadly. We seek innovative, science-based solutions to help feed a growing population, while conserving natural resources. Together with partners, we are committed to advancing 4R Nutrient Stewardship as a sustainable agriculture best management practice. Many stakeholders, including agriculture companies, academic institutions, nonprofit organizations and governments, are working collaboratively with farmers to implement solutions to nutrient losses. For example, groups are engaged on:

- Training and education on 4R Nutrient Stewardship
- Focusing on local conservation programs
- Combining on- and off-field practices
- Conducting watershed research projects
- Considering nutrient trading
- Improving data collection
- Enhancing soil testing methods
- Evaluating weather criteria as part of crop nutrient application planning
- Using variable rate planning and technology

Mosaic has been actively engaged on phosphate product stewardship for years. Since 2004, The Mosaic Company and The Mosaic Company Foundation have invested more than \$19 million in water-focused programs and partnerships promoting nutrient stewardship, habitat conservation and watershed restoration in priority watersheds. In addition, we have partnered with over 100 organizations on water-focused initiatives, including 20 organizations on nutrient stewardship initiatives.

We also collaborate with a wide range of agriculture stakeholders, including International Plant Nutrition Institute, Fertilizer Canada, International Fertilizer Association, The Fertilizer Institute and Agricultural Retailers Association to promote and provide information on 4R Nutrient Stewardship and sustainable agricultural systems.

We also recognize there is more to be done. We continue to extend our market leadership, provide product expertise, and advocate for increased efficiency of phosphate nutrients in cropping systems on farmland.

\$19+ MILLION
total invested in water-related initiatives since 2004

100+ PARTNERSHIPS
on water-focused initiatives, including 20 on nutrient stewardship initiatives

Our Nutrient Stewardship Actions:

Promote

4R Nutrient Stewardship through communication and education

Partner

with non-governmental organizations in priority watersheds

Invest

in product research and development to increase yields and reduce nutrient loss

Engage

and invest in strategic 4R Nutrient Stewardship programs that:

- Add production and environmental value to our customers
- Reinforce industry associations' efforts to provide nutrient stewardship leadership
- Provide regulators with science-based solutions

Partnering with Organizations to Improve Water Quality

Mosaic and The Nature Conservancy Bring 4R Nutrient Stewardship to Farmers

Since 2013, Mosaic and The Mosaic Company Foundation have supported The Nature Conservancy to promote 4R Nutrient Stewardship in important locations throughout North America. The Conservancy's leadership in the Western Lake Erie Basin convenes and mobilizes agricultural retailers, farmers, and interested stakeholders to adopt and advance the voluntary 4R Nutrient Stewardship Certification program. Through science-based 4R best management practices, farmers, retailers, environmental groups and industry are working to improve water quality in the Western Lake Erie Basin in Indiana, Michigan and Ohio.



The Nature Conservancy is a leading conservation organization working around the world to protect ecologically important lands and waters for nature and people. Expertise in nutrient stewardship and conservation agriculture best practices enables The Nature Conservancy to share success across geographies. The Mosaic Company Foundation's support of this certification program ensures that information sharing and the incorporation of new research and technologies will help to improve water quality in Lake Erie.

Momentum is growing. Interested groups in several states are exploring how they might implement the 4R Nutrient Stewardship Certification program and principles to achieve their sustainability goals.

Helping Farmers while Conserving Wildlife with Ducks Unlimited

At Mosaic, we're committed to promoting on-farm best practices that improve nutrient stewardship, conserve wildlife habitat, and help farmers stay productive and profitable. To help us achieve these goals, we partner with Ducks Unlimited, USA Rice, and more than 40 supply chain partners on the Rice Stewardship Partnership in the Mississippi Alluvial Region of the U.S.—where rice farming meets migratory flyways.

Rice agriculture in the Southeastern U.S. is well suited for North America's ducks and other waterbird populations—providing managed wetland habitat and food resources. This region is also where a large majority of rice is grown for U.S. production.



Any water that goes on the field must eventually cycle back into the environment. To help ensure any fertilizer applied to a rice field is used by the rice crop and not drained into a river or lake, Ducks Unlimited and Mosaic are working together to educate rice farmers on 4R Nutrient Stewardship practices. By following 4R Nutrient Stewardship practices, rice farmers can help improve water quality locally and downstream by capturing crop nutrients that might otherwise enter the Mississippi River.

Mosaic joined the Rice Stewardship program in 2015. By 2020 over 400,000 rice acres are projected to be enrolled in the program. With approximately 3.2 million acres of rice grown in the U.S. today, this represents a large-scale effort.