



4R NUTRIENT STEWARDSHIP A Policy Toolkit

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International Fertilizer Industry Association (IFA)

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4R NUTRIENT STEWARDSHIP

A Policy Toolkit

What is the fertilizer industry doing to promote nutrient stewardship?

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RATIONALE

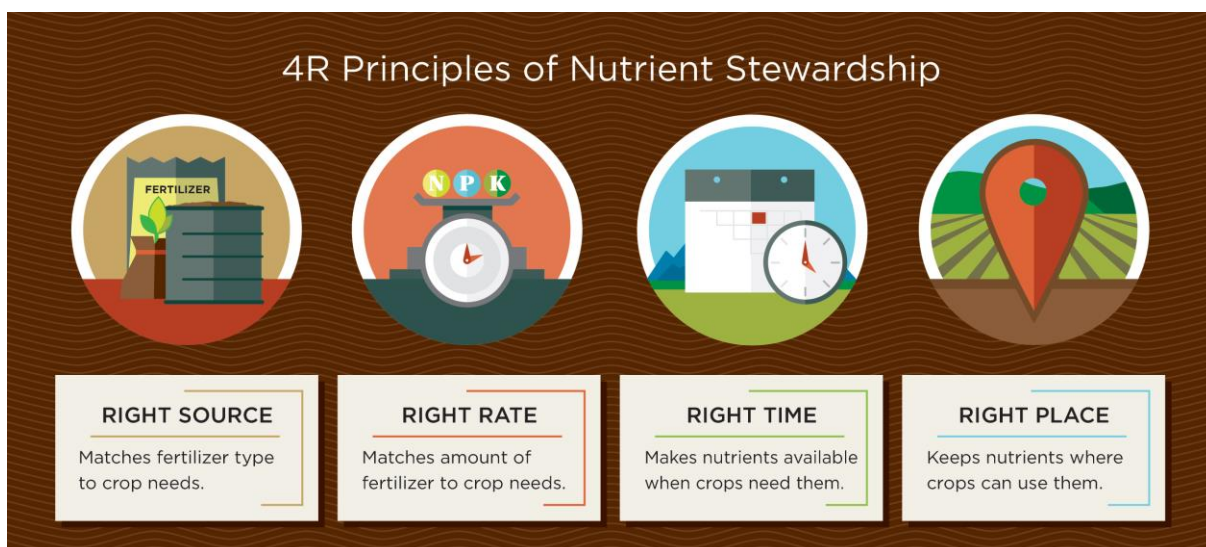
Optimized use of fertilizers by farmers around the world is necessary for food and nutrition security and for safeguarding natural resources and ecosystems. The fertilizer industry has taken up nutrient stewardship as a priority area of work in support of this fact.

Fertilizers – of an organic or mineral nature – replenish soil nutrients removed after each harvest, provide nutrients to plants so they can grow bountiful crops, ensure higher agricultural yields and thus make an important contribution to food security. Utilizing fertilizers to increase productivity of existing arable land helps slow down encroachment on forests and natural habitats, thereby making an important contribution to biodiversity preservation and climate change mitigation.

The benefits of nutrient stewardship include reduced environmental impact, increased productivity and biodiversity preservation. More judicious use of fertilizers by farmers also enables them to improve farming profitability. One industry framework seeking to achieve these outcomes is 4R nutrient stewardship.

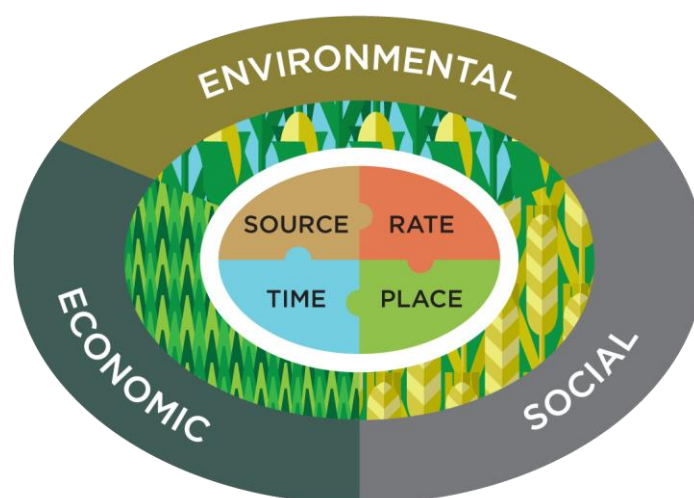


Nutrient stewardship promotes effective nutrient use to maximize nutrient uptake by plants in a cropping system. This also has the effect of minimizing nutrient losses to the environment, as they can have negative impacts on water, soil and air. The fertilizer industry is a strong promoter of nutrient stewardship and a proponent of best management practices in fertilizer application on farms around the world. Effective nutrient stewardship programs integrate the “4R” principles, which encourage farmers to apply the right source of nutrients, at the right rate, time and place.



OVERVIEW

4R Nutrient Stewardship is an innovative approach for fertilizer best management practices which considers the economic, social and environmental dimensions of nutrient management. The concept entails using best management practices to apply the right source of nutrient, at the right rate, at the right time and in the right place (4R).



The 4R Nutrient Stewardship approach is an essential tool in the development of sustainable agricultural systems because its application can have multiple positive impacts to increase food production in an economically viable way while preserving the environment.

- **Natural capital benefits:** better crop performance, improved soil health, reduced environmental impacts, and protection of biodiversity.
- **Economic benefits:** increase in farmers' profits, and economic improvement in their communities.
- **Social benefits:** reduced prevalence of hunger and malnutrition, improved rural livelihoods, stronger farming communities.

4R is a farmer-centric approach

The farmer is the steward of the land and the final decision-maker in selecting practices best suited to a farm's operations. Farmers' decisions are site-specific and consider many factors, such as soil, weather, and crop production conditions, economic and risk management considerations, as well as their interlinkages and connections with local goals set by public and private stakeholders.

4R is based on sound agronomic science

Scientific principles guide the development of practices related to source, rate, time and place. Farmers and crop advisers make sure the practices they select and apply locally are in accord with these principles. The principles are the same globally, but how they are put into practice locally varies depending on each farm and taking into consideration their level of access to knowledge and technology as well as specific characteristics such as:

- Soil
- Crop
- Climate
- Weather
- Economic
- Social Conditions

4R interacts with other plant management practices such as tillage, irrigation, drainage, crop rotation, cultivar selection, plant protection and weed control.

4R promotes adaptive management involving an ongoing process of developing improved practices for efficient production and resource conservation by use of participatory learning through continuous systematic assessment.



4R NUTRIENT STEWARDSHIP CAN
HELP GROW CROPS SUSTAINABLY

THE 4Rs INCREASE PRODUCTION/PROFITABILITY FOR
FARMERS WHILE ENSURING THE FUTURE OF THE AGRICULTURAL INDUSTRY



4Rs AT A GLANCE

No single R is more important than the others and all have to be taken in consideration.

Right source principles:



Plants need 16 macro and micronutrients to grow well. It is important to match specific nutrient needs of crops and soils with the right nutrient type for balanced crop nutrition and to avoid nutrient deficiencies. Nutrients applied should be plant-available, or is in a form that converts in a timely fashion into a plant-available form in the soil. The nutrient applied suits the physical and chemical properties of the soil. And, compatibility is taken into account when blending different sources of nutrients.

Right rate principles:



It is important to apply the right rate of nutrients to meet a plant's nutrient needs. When determining the right nutrient rate, it is important to set an attainable yield target to estimate crop nutrient requirements. It is also necessary to assess the nutrients already available in the soil, as well as alternative nutrient sources - such as biological nitrogen fixation, manure, composts, biosolids, crop residues, atmospheric deposition and irrigation water - to ensure the adequate amount of additional nutrients are added.

Right time principles:



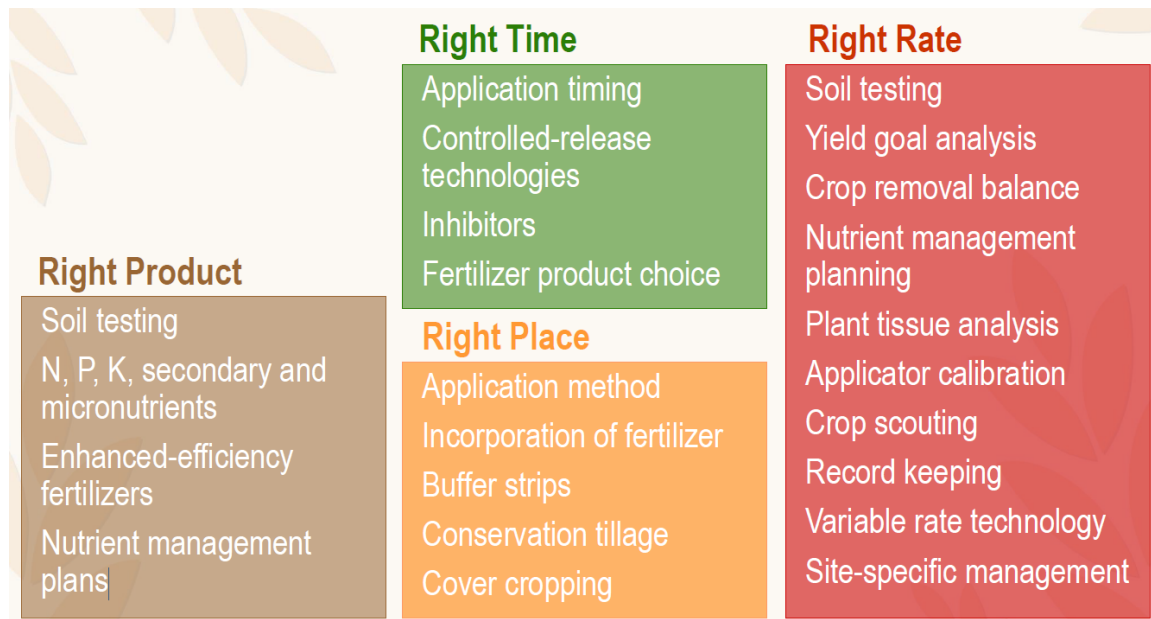
To maximize nutrient uptake by plants, nutrients should be applied at the right time, when the plant can best access and use the nutrients. Nutrients should be applied to best match the seasonal crop nutrient demand. It is useful to assess the dynamics of soil nutrient supply and of soil nutrient loss. Climate patterns and rainfall should also receive consideration when making timing decisions.

Right place principles:



Nutrients placement can address both spatial variations across a field and nutrient dynamics in the soil. Specifically, plant uptake of less mobile nutrients like phosphorus and potassium is enhanced when these nutrients are placed closer to the plants root zone. Nutrient placement can also be targeted using variable rate application across a field when high yielding and low yielding zones are identified. Additionally, nutrient placement must work in conjunction with tillage systems; some of which conserve crop residue cover on the soil, to conserve nutrients and water.

EXAMPLES OF BEST PRACTICES IN THE 4 MANAGEMENT AREAS



4R NUTRIENT MANAGEMENT IN AFRICAN AGRICULTURE

Increasing yields in sub-Saharan Africa (SSA) is essential to meet food and nutrition security. Poor soil fertility in the region resulting from nutrient mining (ongoing agricultural production without sufficient nutrient replenishment) continues to fuel dramatic and unacceptable yield gaps. Cereal yields in Africa are only one tenth of those in the United States as document in the [Africa Progress Panel report](#) and the [Montpellier Panel report](#) “Sustainable Intensification: A New Paradigm for African Agriculture”. Soil fertility refers to the capacity of soil to supply essential plant nutrients in the amount and form that a plant can take up. The fertilizer industry recognizes that merely increasing fertilizer application rates will not benefit farmers unless they have the knowledge to use fertilizer in the correct and most efficient way and in conjunction with other inputs and good agronomic practices. The majority of farmers in SSA are smallholder subsistence farmers, cultivating land units of less than 2 hectares. The introduction and dissemination of improved fertilizer management has direct effects on their food security and livelihoods. Extension agents and agro-dealers play an important role to help farmers make good decisions on the purchase and use of fertilizer. Demonstrating 4R practices to farmers through conversation, articles, demonstrations and meetings helps farmers understand how good fertilizer management will lead to higher crop yields and income. Fertilizer companies and other actors in the value chain are increasingly stepping in and providing extension services in regions where governments are not able to undertake the task. The fertilizer industry has documented [a series of case-studies](#) about private sector-led extension initiatives.

INTEGRATED SOIL FERTILITY MANAGEMENT



Africa is uniquely positioned to undergo agricultural intensification in a sustainable manner. By introducing (in some areas for the first time) fertilizer application concomitantly with Integrated Soil Fertility Management and the 4Rs, African soils can be replenished and restored in a way that is mindful of the environment. Losses can be reduced and fertilizer can be used in a cost-efficient manner that is more affordable to smallholders.

Integrated soil fertility management (ISFM) is a set of agricultural practices adapted to local conditions to maximize the efficiency of nutrient and water use and improve agricultural productivity. ISFM strategies center on the combined use of mineral fertilizers and locally available soil amendments (such as lime and phosphate rock) and organic matter (crop residues, compost and green manure) to replenish lost soil nutrients. This improves both soil quality and the efficiency of fertilizers and other agro-inputs

Bundling together fertilizer tailored to region-specific needs with knowledge of agronomic and fertilizer best management practices has the propensity to increase yields and farmers' income. In addition, fertilizer companies are working with partners in the agri-food chain to make their products and the knowledge to use them appropriately available to as many farmers as possible.

US and CANADA 4R RESEARCH FUND

Developed countries face challenges to reduce environmental impacts in productive and profitable cropping systems. The dynamics of nutrients between and within soil, plants and the environment are complex. Understanding the impacts of fertilizer best management practices on the economic, environmental and social aspects of sustainable agriculture are key within 4R nutrient stewardship. To better address knowledge gaps regarding 4R implementation, fertilizer industry members in the United States and Canada initiated the 4R Research Fund. The 4R Research Fund receives contributions from industry members and stakeholders to implement analyses and research and demonstration projects in the US and Canada to evaluate 4R practices. The industry has committed to providing \$7M in research funds over a five year period.

4R ROLE IN THE GLOBAL POST-2015 SUSTAINABLE DEVELOPMENT AGENDA

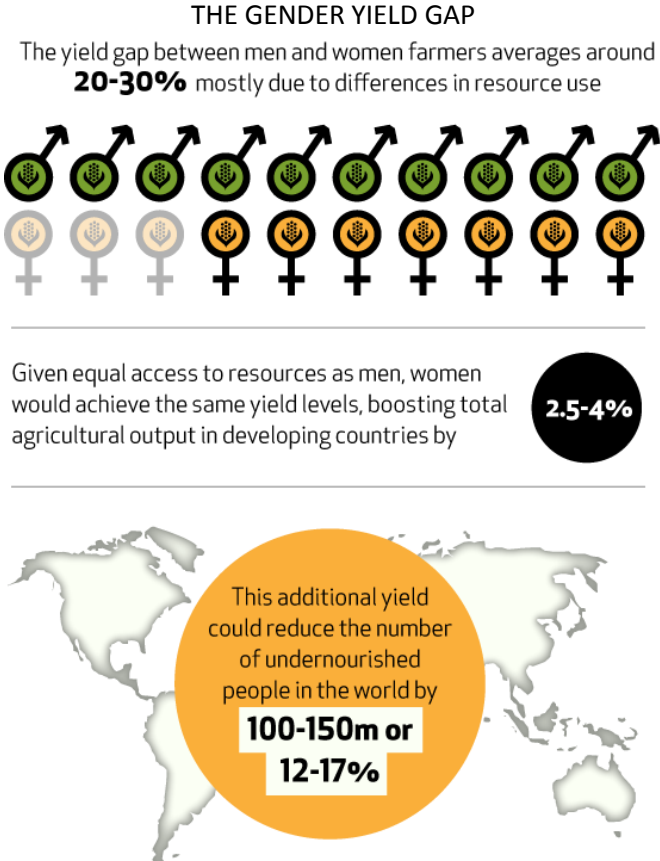
The effective application of fertilizers is important to the implementation of the post-2015 agenda, in particular for two of the proposed SDGs namely Goal 2 “End hunger, achieve food security and improved nutrition and promote sustainable agriculture” and Goal 15 “Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.”

The fertilizer industry is committed to continue working together with all stakeholders by forming strategic partnerships to eradicate hunger and malnutrition and enhance sustainable agriculture. A significant part of the solution to ending hunger and malnutrition lies within the soils. The SDG

agenda presents a great opportunity to strengthen outreach to farmers who are the stewards of the world’s soils. The fertilizer industry is committed to working with governments, NGOs and other stakeholders to improve knowledge transfer to farmers. IFA joined the Global Soil Partnership and is in the steering committee for the celebrations of the International Year of Soils. IFA sits on the steering committee for the Global Partnership for Nutrient Management (GPNM) and has been a member of the Global Alliance for Climate-Smart Agriculture (GACSA) since its inception.

Through appropriate and balanced fertilization, soils can be restored or improved and the benefits of healthy soils translate directly into more bountiful crops and in foods with increased bioavailability of micronutrients.

The 4Rs nutrient stewardship framework is inclusive and encompassing. It is easily tailored to both developed and emerging countries. It places the farmer – who are the end users of our products - at the core of the decision-making process, taking into account stakeholders’ priorities. By granting farmers agronomic knowledge and fertilizer best management practices organized along the 4R concept, they are empowered to increase their yields and income, while improving health of their soils and protecting the environment. This is particularly true for women farmers who have much less access to productive resources, in particular inputs. The FAO demonstrated that by giving women farmers access to fertilizers and other resources, agricultural productivity globally would increase by 20-30%.



The [Female Face of Farming](#), Farming First, 2012

4R VIDEOS



Roots for Growth: Feeding the World

CFI emphasizes 4R Nutrient Stewardship as a solution to sustainable food security and soil health for generations



4R Nutrient Stewardship - PART 1 of 2

4R Nutrient Stewardship - PART 2 of 2

An overview of the 4Rs. How these concepts apply to large-scale agriculture in developed countries and also to small-holder farms in less developed regions. Through graphics and field scenes, the presentation provides more insight for further understanding of the 4Rs.



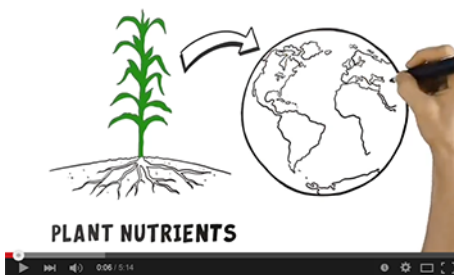
4R Nutrient Stewardship Adoption in Sub-Saharan Africa: Challenges and Opportunities

Dr. Shamie Zingore, IPNI Director, Sub-Saharan Africa Program, leads us through the region's current challenges and discusses the limitations of smallholder farming systems and their surrounding infrastructure. A pilot project is aimed at training and building the capacity for extension workers and the supporting farm retail sector so they can extend site-specific 4R knowledge to farmers.



The Right Way to Grow Rice ... 4R Nutrient Stewardship

Rice is life ... for about three billion people in the world today. Improved fertilizer management is now more critical than ever in order to achieve the necessary increases in rice yield and quality. This video details how growers can apply the right fertilizer source, at the right rate, at the right time, and in the right place needed to meet their rice production goals.



The Role of 4R Nutrient Stewardship in Reducing Greenhouse Gas Emission

IPNI explains how farmers make 4R decisions to minimize greenhouse gas emissions resulting from their nitrogen fertilizer applications.

More 4R videos on youtube...