



IPNI
INTERNATIONAL
PLANT NUTRITION
INSTITUTE

Getting Nitrogen Management Right: The 4 R's

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Agrium Inc.



Arab Potash Company



Belarusian Potash Company



CF Industries Holdings, Inc.



Compass Minerals Specialty Fertilizers



Incitec Pivot



International Raw Materials LTD.



Intrepid Potash, Inc.



K+S KALI GmbH



The Mosaic Company



OCP S.A.



PotashCorp



Qatar Fertiliser Company (QAFCO)



Simplot



Sinofert Holdings Limited



SQM



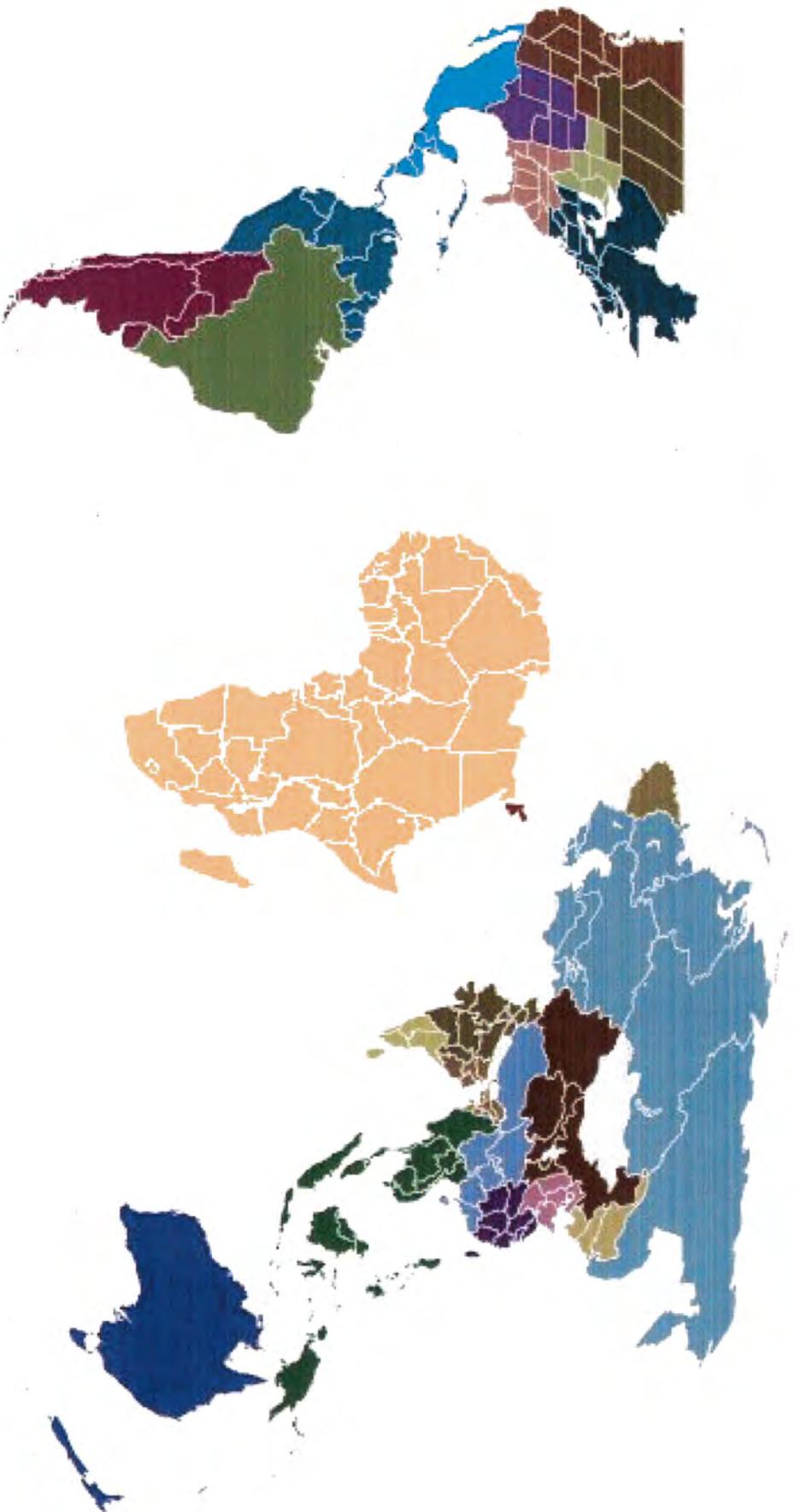
Uralkali

Started in 1935, the **International Plant Nutrition Institute** is supported by the leading global fertilizer manufacturers.



IPNI Mission

“to develop and promote scientific information about the responsible management of plant nutrition for the benefit of the human family.”



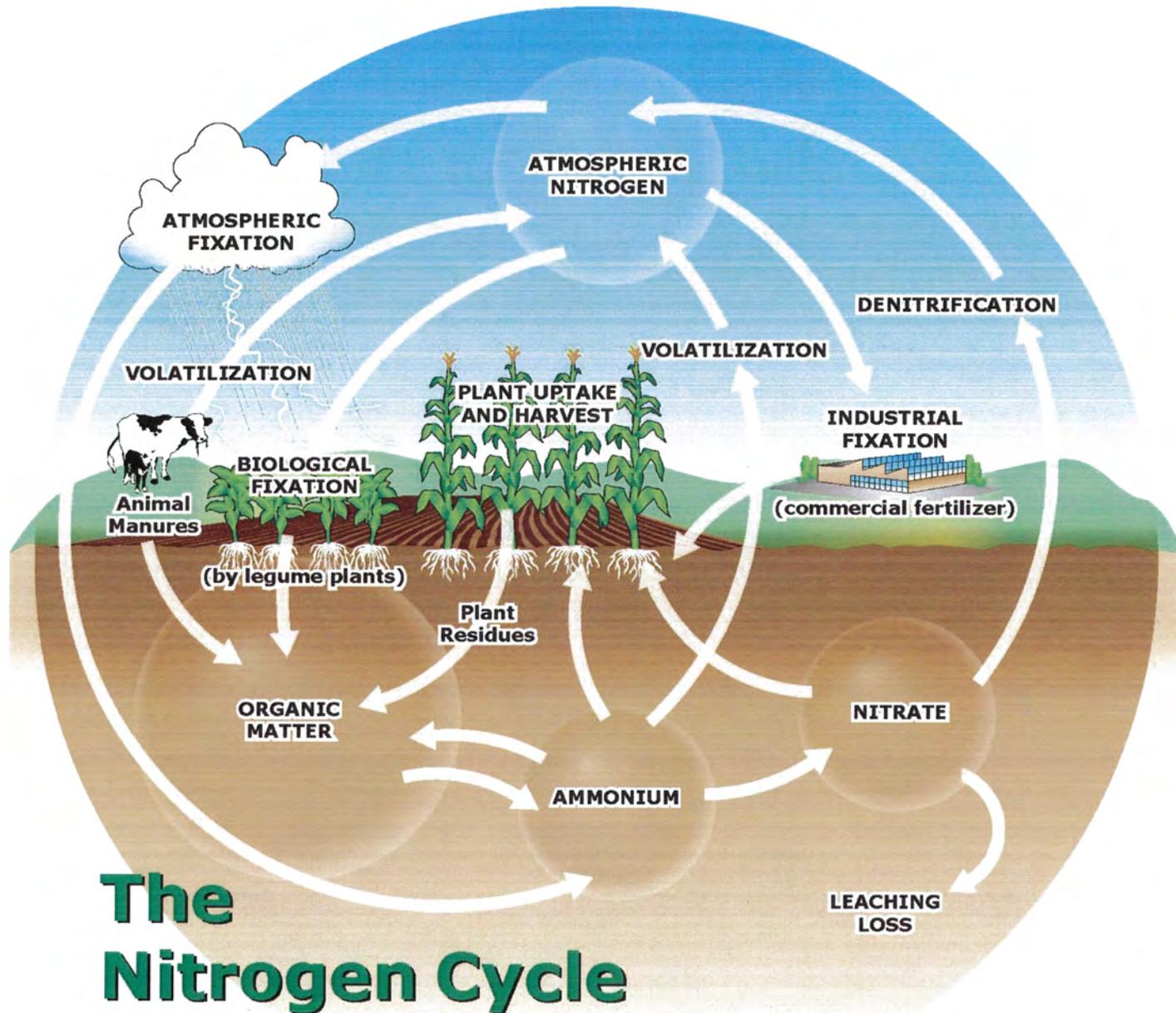
Nitrogen Fertilizer Plays a Vital Role in Civilization

“Without the use of N fertilizers, we could not secure enough food for the prevailing diets of nearly 45% of the world’s population, or roughly 3 billion people...” [Smil, 2011]



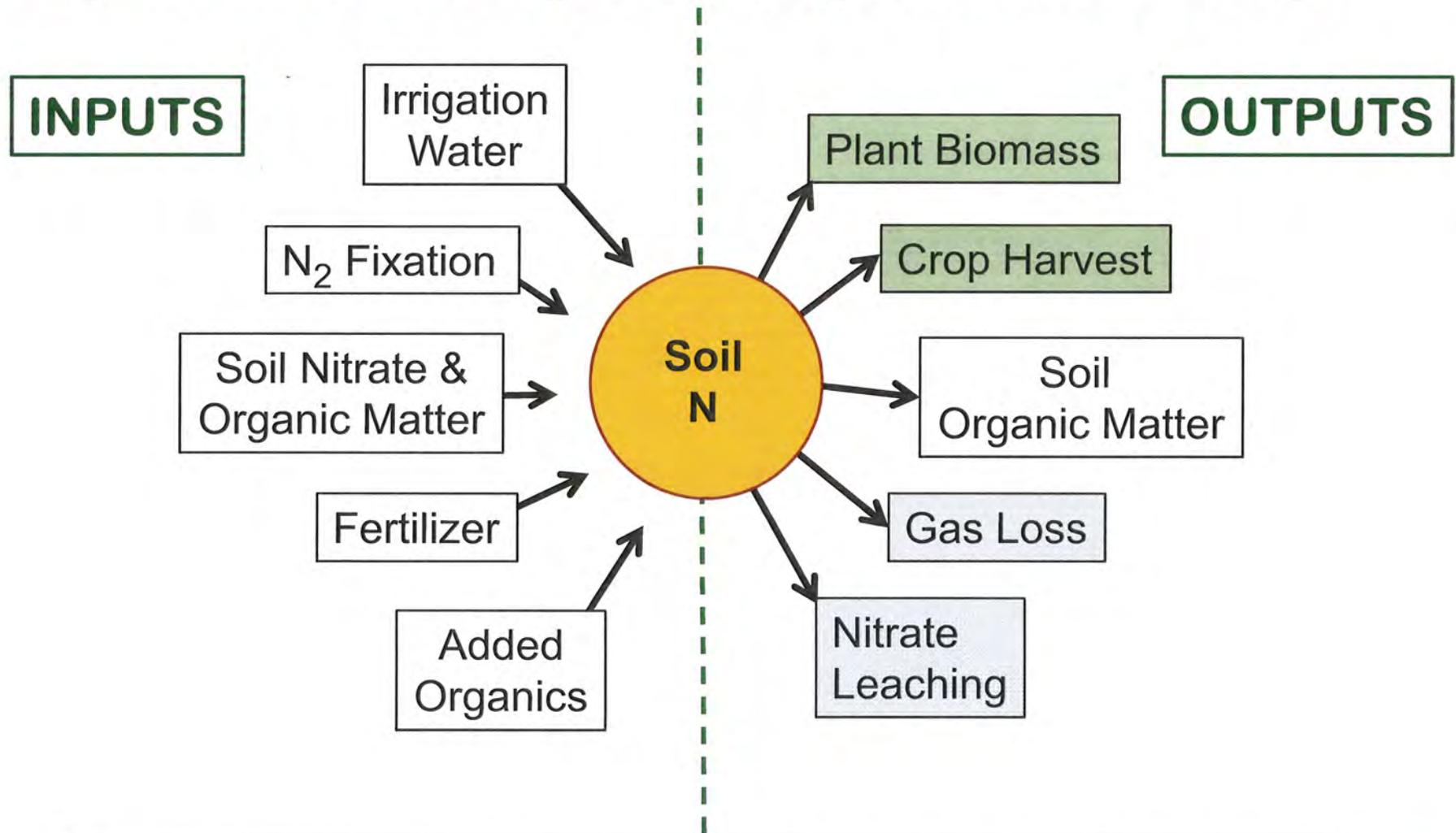
Smil, V. 2011. Nitrogen cycle and world food production. *World Agriculture* 2:9-13.





Reality:

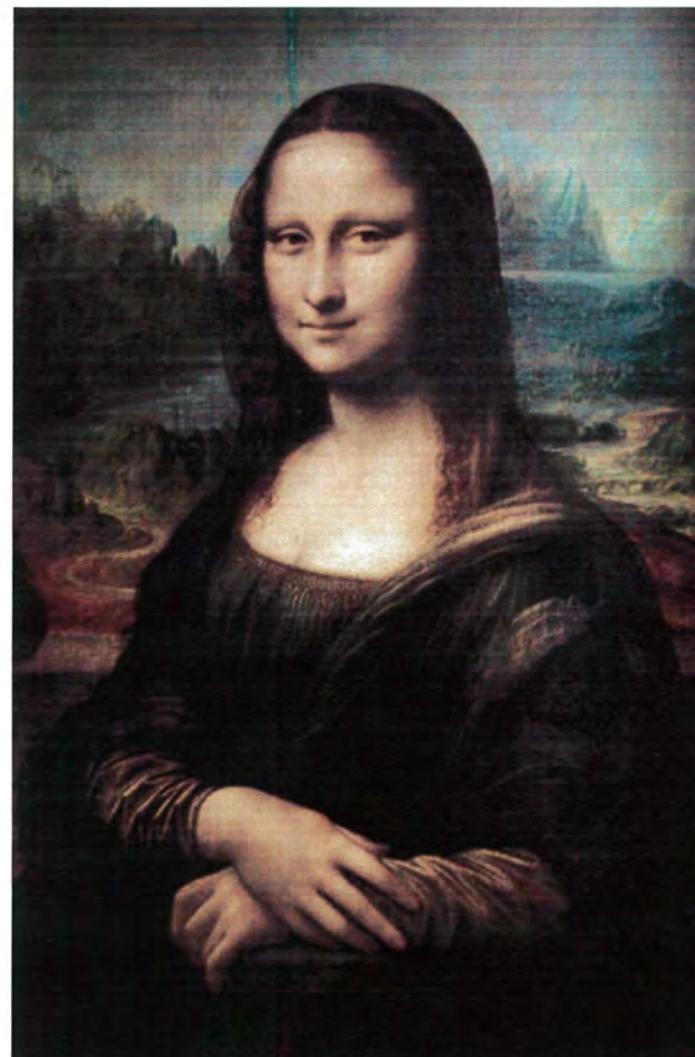
Agricultural Nitrogen Management Challenge



Many processes are variable, uncontrollable, or poorly predicted



Nitrogen Management is both Science and Art



Nitrogen Management – Rate Alone?



The “4R” strategy

Right Source at

Right Rate

Right Time

Right Place

For the crop, field or field zone, and nutrient



Challenges in Understanding the Fate and Transport of Nitrogen

Some examples:

- What is the fertilizer replacement value of irrigation water nitrate?
- How fast do organic materials release nitrogen?
- Poor water management can negate the best nitrogen plan
- Account for complex rotations and low harvest index (removal)
- Wide range of soil conditions throughout the Valley
- Rooting zone for crops? [from 1 foot to 7 feet]
- How can enhanced-efficiency fertilizers improve N recovery?



How to determine nitrogen moving past the root zone?



Direct measurement under each field ?

- Enormous data collection
- Impractical and expensive

Mass loading estimates based on field trials ?

- Must be representative sites in trials
- Requires many assumptions... indirect measure
- Needs new science to quantify components
- More practical, but still not quantifiable

Fate and transport ?

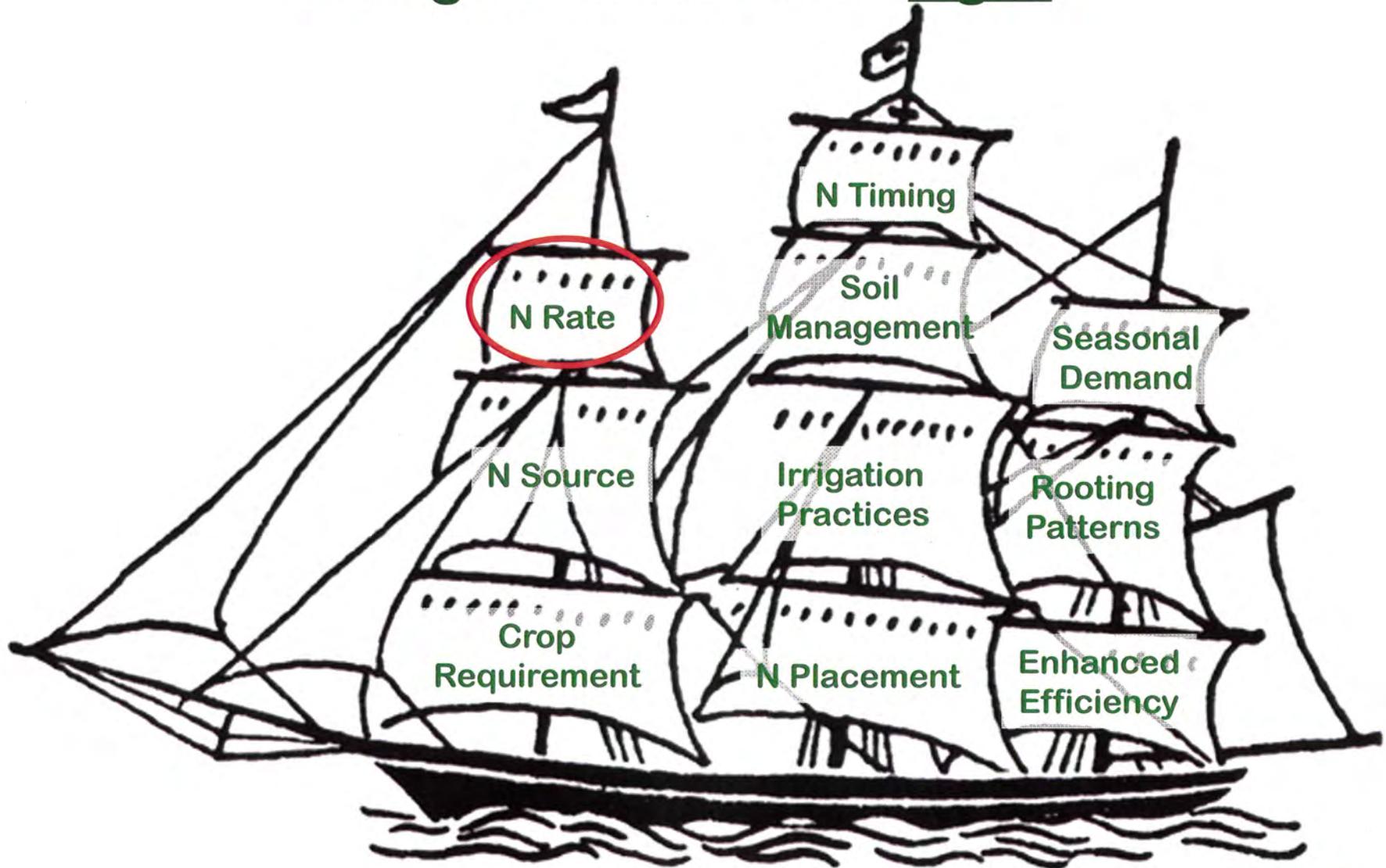
- New science and data needed to validate results and integrate multiple practices



**All of the sails are adjusted properly
to move the ship in the desired direction**



Many interacting factors to adjust to get nitrogen fertilization “right”



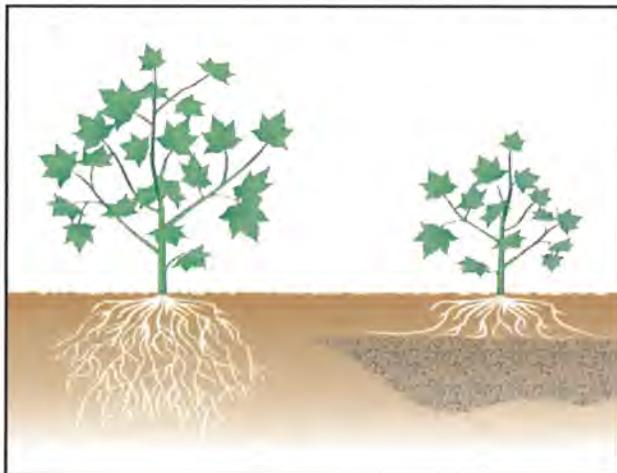
Next Steps?

The science of nitrogen fertilizer management is complex and still developing

Fertilizer industry is working with academic experts, coalitions, and commodity groups to develop tools for nitrogen management

Improved **4R** practices need to be matched with specific crops and soils- then put tools in hands of decision makers and CCA's

Rushing the process ahead of the science will not produce desired water quality results



All partners are committed to rapid progress in improved nitrogen fertilizer management



nutrientstewardship.com



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WHAT ARE THE 4RS

IMPLEMENT THE 4RS

4R TRAINING

4R CONSISTENT SYSTEMS

These systems are consistent with the 4Rs and can help you create a comprehensive 4R nutrient stewardship plan. [Learn more](#) about what it means for a nutrient management system to be 4R-Consistent.

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IMPLEMENT THE 4RS

4R Nutrient Stewardship represents an innovative approach to fertilizer best management practices (BMPs). The 4Rs imply there are four aspects to every fertilizer application and it provides a framework to assess whether a given crop has access to the necessary nutrients. Asking "Was the crop given the right source at the right rate, at the right time, and in the right place?" helps identify opportunities to improve fertilizer efficiency and prevent nutrient movement from each field.

To learn more, please download our brochure:  [Implementing 4R Nutrient Stewardship on the Farm Right Now](#)



This is an example of an unpublished revision.

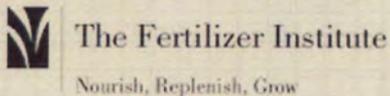
RIGHT SOURCE

RIGHT RATE

RIGHT TIME

RIGHT PLACE

PARTNERS WITH THE PRODUCTS AND SERVICES YOU NEED TO FOLLOW THIS PART OF YOUR 4R PLAN



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