

Industry initiatives enhancing phosphorus sustainability

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and Technology in the Phosphate Industry
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Benguerir, UM6P Congress Center - Morocco



Agrium Inc.



Arab Potash Company



BHP Billiton



CF Industries Holdings,
Inc.



International Raw
Materials LTD



Kingenta Ecological
Engineering Group Co.,
Ltd.



K+S KALI GmbH



The Mosaic Company



OCP S.A.



PhosAgro



PotashCorp



Shell Sulphur Solutions



Simplot



Sinochem Holdings Limited



Yara International ASA

The **International Plant Nutrition Institute** is supported by leading fertilizer manufacturers.

Formed in 2007 from the Potash & Phosphate Institute, its mission is to develop and promote science for responsible management of crop nutrition

Outline

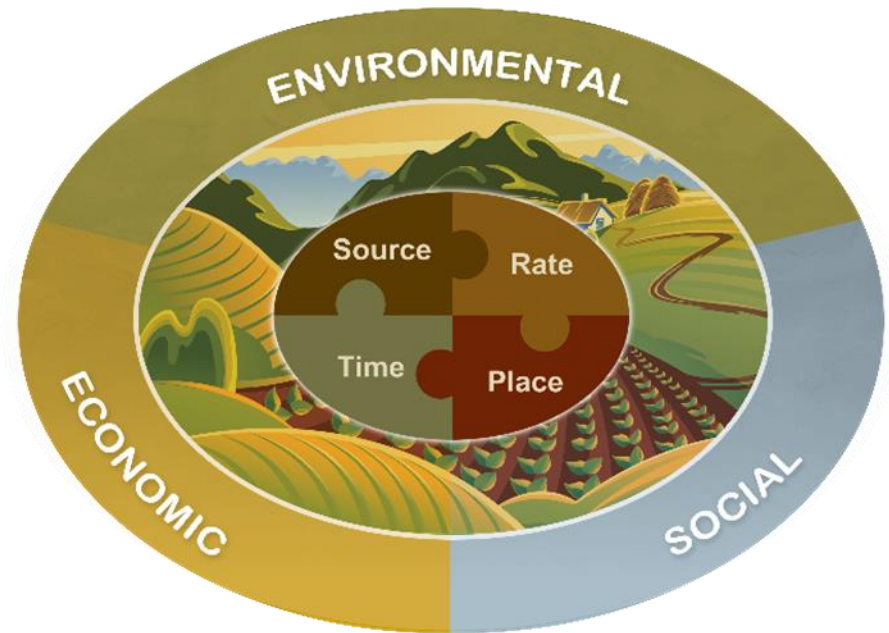
1. Phosphorus Sustainability Issues

2. Lake Erie Watershed

- 4R practices
- 4R program

3. Africa

- 4R practices
- 4R program in Kenya



<http://phosphorus.ipni.net>

Phosphorus Sustainability Initiatives:

- resource consumption & use efficiency
- trace element loading
- water quality impacts



**Sustainable
Phosphorus
Alliance**

“Phosphorus Footprint”

“Peak Phosphorus”



**PHOSPHORUS,
FOOD,
and our FUTURE**



Edited by
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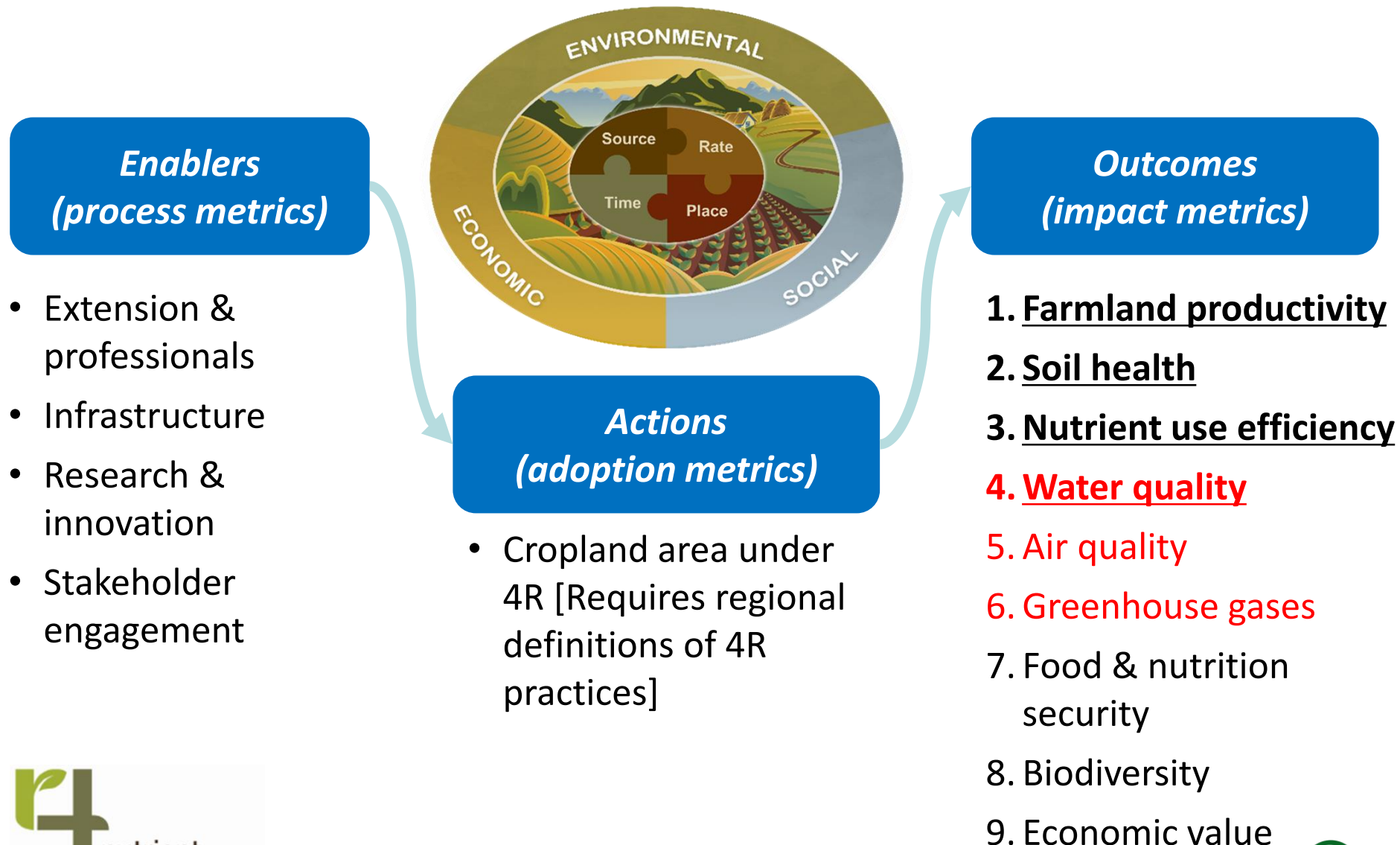
**Sustainable
Phosphorus
Management**

A Global Transdisciplinary Roadmap

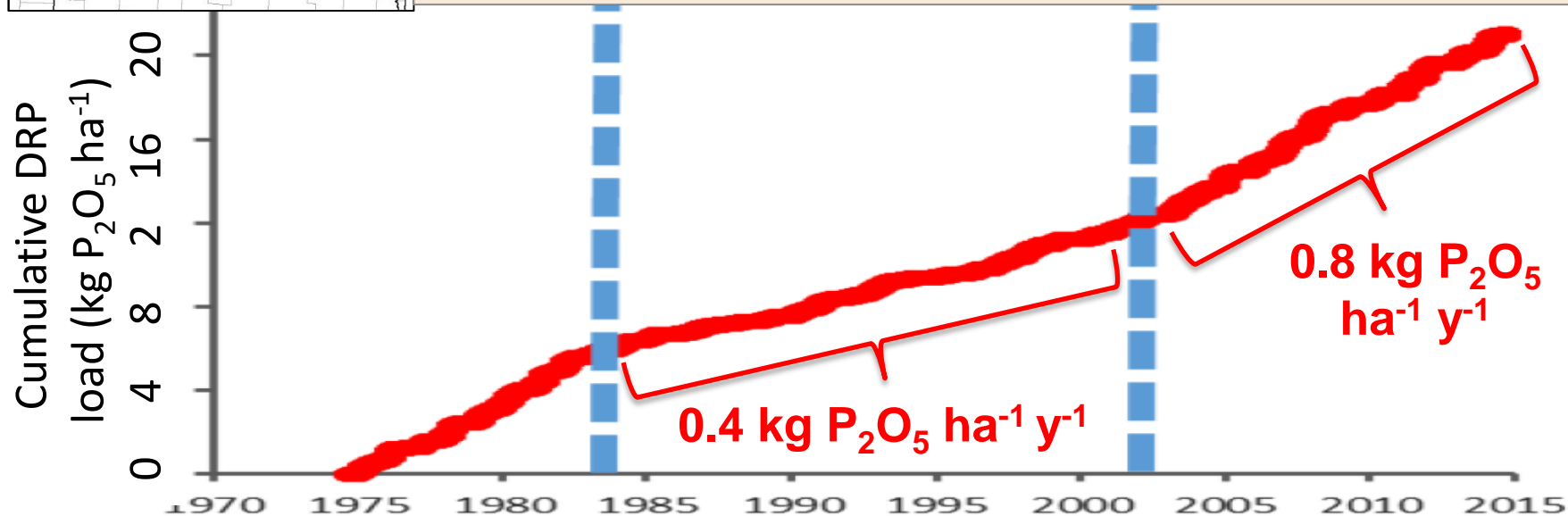
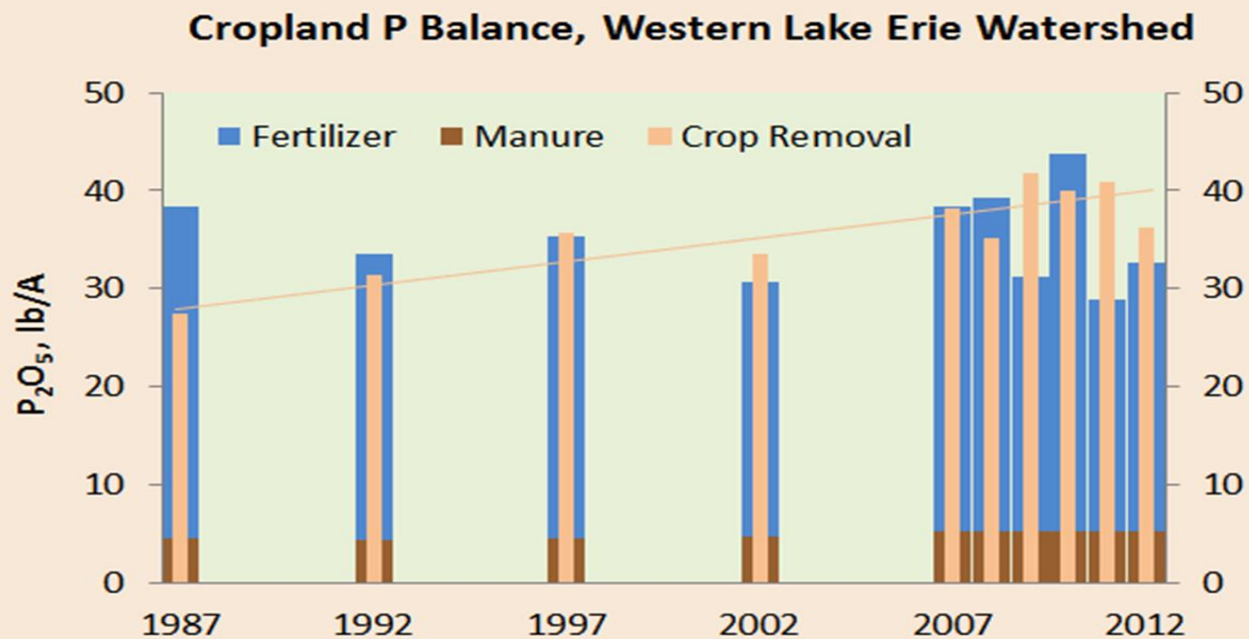
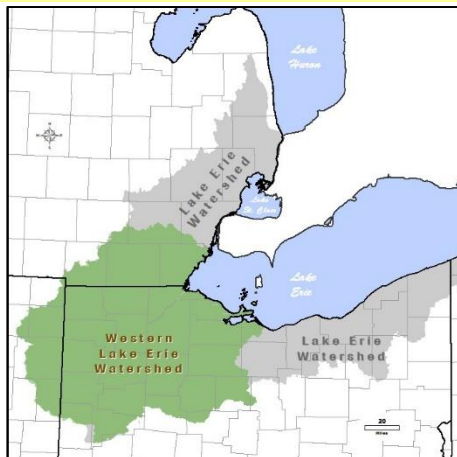
As a sustainability system, 4R Nutrient Stewardship needs METRICS.



Nutrient Stewardship Metrics for Sustainable Crop Nutrition



Western Lake Erie: dissolved P trends increasing since 2002



4R Research Fund

LEW project:

Monitoring P loss at edge of field & in stream



Funding Sources:

4R Research Fund USA-4RN09

USDA-ARS: USDA-Agriculture Research Service

CEAP: Conservation Effects Assessment Project

EPA: DW-12-92342501-0

Ohio Agri-Businesses

Ohio Corn and Wheat Growers

CIG: 69-3A75-12-231 (OSU)

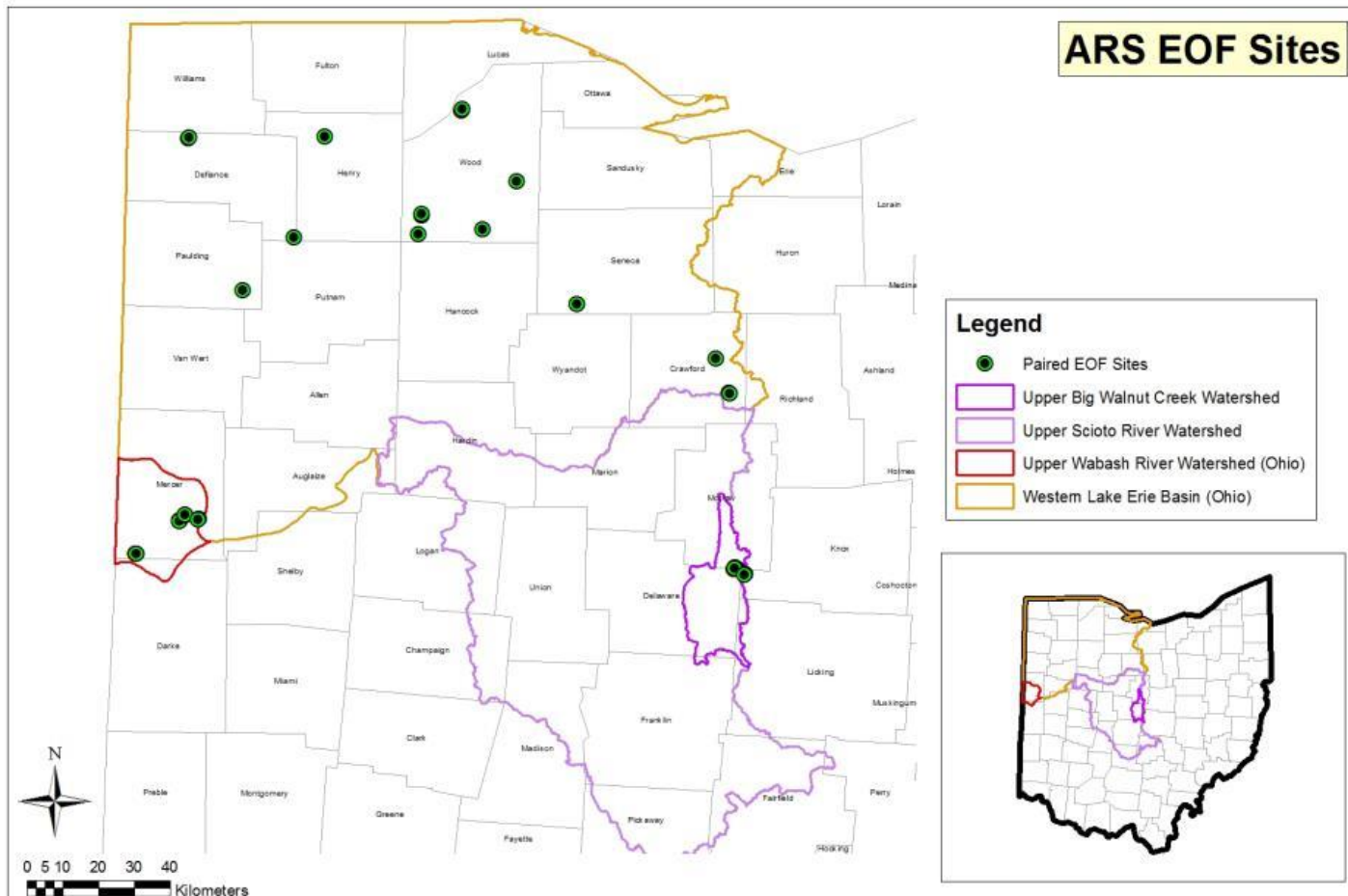
CIG: 69-3A75-13-216 (Heidelberg University)

MRBI: Mississippi River Basin Initiative

The Nature Conservancy

Becks Hybrids/Ohio State University

Ohio Soybean Association



Lake Erie Watershed 4R Research – findings to date

1. Incorporation (“right place”) of broadcast fertilizer reduced P loss in tile drains by 45%
2. Soil test P in the top 5 cm of soil was up to 3 times higher than in the top 20 cm; on average, 1.5X.
3. One third of the increase in dissolved P loads since 2002 can be attributed to increased river flow.
4. Farmers express concern for their impact on the lake, and up to 90% are willing to change practices.
5. Collaborating brings rewards.

WESTERN LAKE ERIE BASIN 4R CERTIFICATION PROGRAM

Program for Agricultural Retailers & Service Providers Implementing the 4Rs

**CERTIFICATION
PROGRAM GOALS**

**TRAINING & EDUCATION
REQUIREMENTS**

**MONITORING
4R IMPLEMENTATION**

33 Partner Organizations:

- 10 Agri-retailers
- 7 Environmental organizations (TNC, EDF, and soil/water coalitions/federations)
- 5 Fertilizer industry organizations (IPNI, TFI and state associations)
- 5 Government agencies (state and federal)
- 4 Farmer organizations
- 2 Land Grant Universities

4R FARMERS & THE LAKE

Sustainable Crop Nutrition for the Western Lake Erie Basin

nutrientstewardship.org

Fertilizer Benefits

Fertilizers replenish **soil nutrient supplies** depleted by crop production



Within the watershed, crop harvest removes more **phosphorus** than is being applied as fertilizer and manure.

Fertilizers are key to **food security**



50% of **food production** is the result of fertilizer use



4R PRINCIPLES OF NUTRIENT STEWARDSHIP

RIGHT SOURCE

Matches fertilizer type to crop needs



- Account for **all** sources of nutrients in recommendations

RIGHT PLACE

Keeps nutrients where crop can use them



- Utilize variable rate application
- Utilize phosphorus injection, subsurface banding or broadcasting with immediate incorporation
- Don't broadcast apply nutrients without incorporation unless the risk of phosphorus loss is demonstrated to be low
- Apply nutrients using minimum setbacks from sensitive areas

RIGHT RATE

Matches amount of fertilizer to crop needs



- Conduct soil tests regularly in uniform areas less than 25 acres
- Document crop yield goals based on crop history
- Base nutrient application on Tri-State recommendations or adaptive management using soil test and yield goals
- Calibrate nutrient application equipment annually

RIGHT TIME

Makes nutrients available when crops need them



- Don't apply phosphorus on frozen or snow covered ground
- Don't apply phosphorus or nitrogen if a large rainfall is in the weather forecast

**We All
Play A
ROLE**



4R NUTRIENT STEWARDSHIP
CERTIFICATION PROGRAM

38

CERTIFIED
BRANCH
FACILITIES



1,875,000

ACRES IN WLEB



905,000

ACRES
OUTSIDE WLEB



39

BRANCH
COMMITMENTS



2,780,000

TOTAL ACRES



3,500

CLIENTS SERVICED
IN WLEB



1,700

CLIENTS SERVICED
OUTSIDE WLEB



5,200

TOTAL CLIENTS



- Program launch spring 2014.
- Requires rigorous third-party audit of 40+ criteria.
- Current reach nearly half the cropland in the western Lake Erie watershed.

The 4R R&D Program in Sub-Saharan Africa



The Context

The
framework

Research

Dissem-
ination

Capacity
building

Impact

The Need for 4Rs

Unbalanced fertilization



Wrong placement



Wrong timing



Poor agronomy



The Context

The
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Research

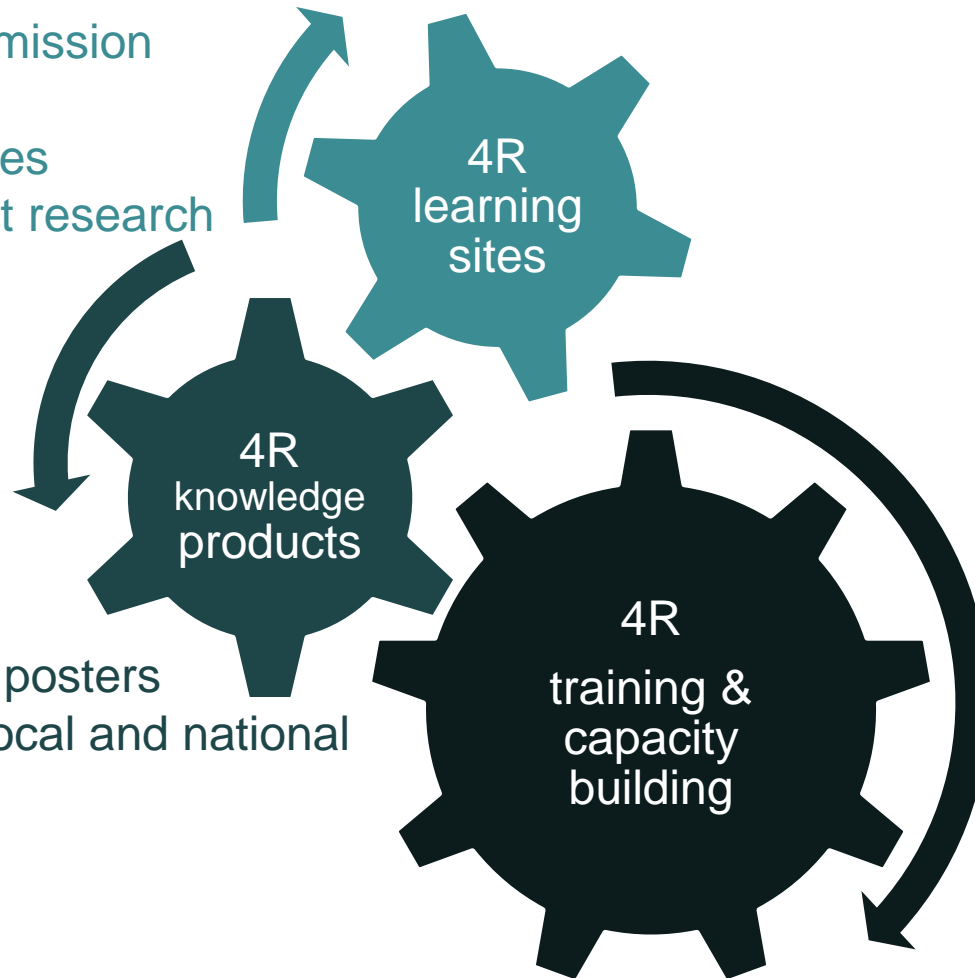
Dissem-
ination

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Project focus and activities

- Long-term nutrient omission trials
- 4R demonstration sites
- 4R lime management research sites



- 4R handbook – SSA
- Extension booklets & posters
- 4R news articles for local and national media
- 4R videos

- Field training for lead farmers
- Training workshops for extension agents & fertilizer dealers
- Msc student training

The Context

**The
framework**

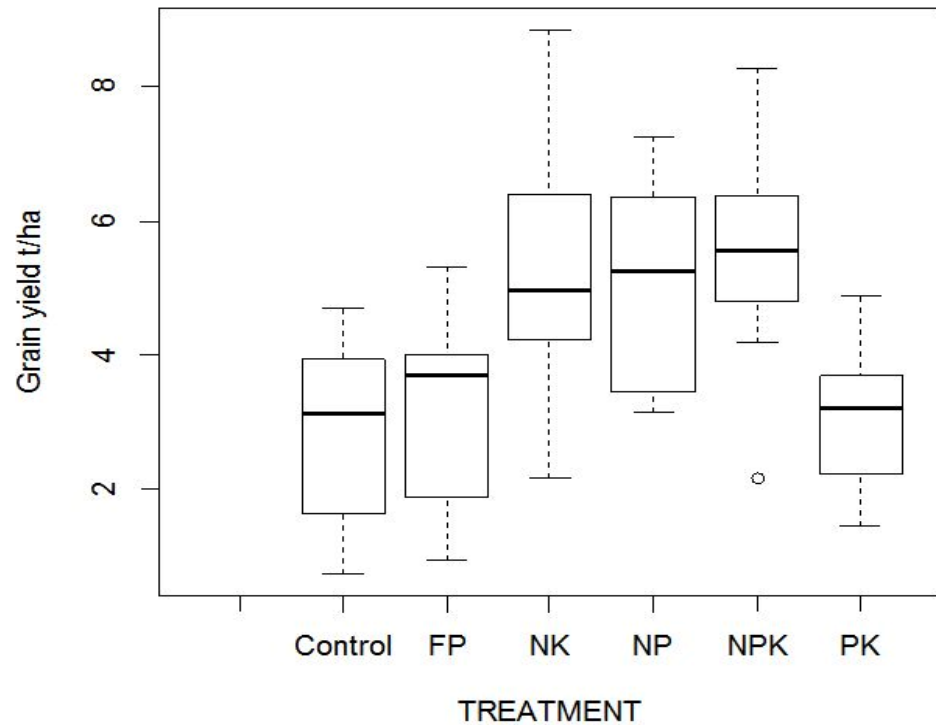
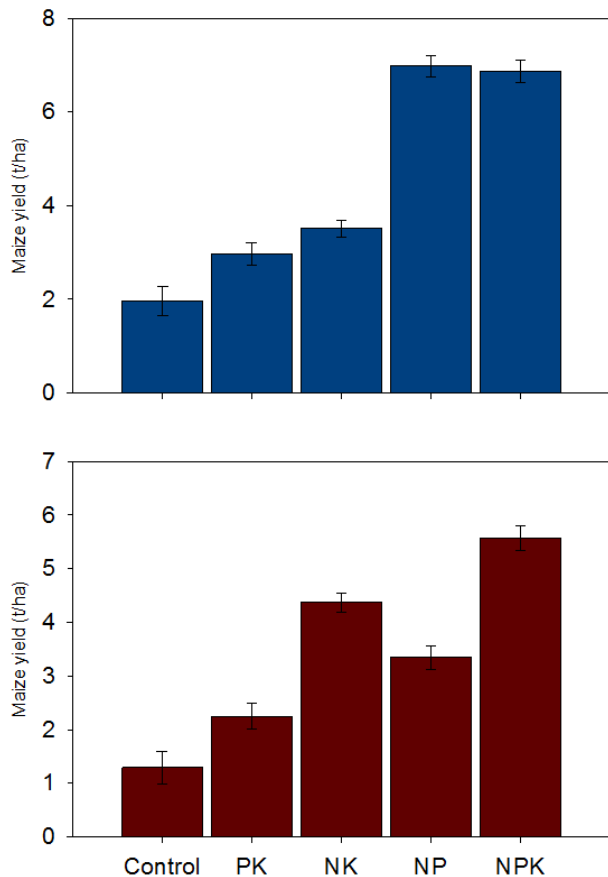
Research

**Dissem-
ination**

**Capacity
building**

Impact

4R adaptive research: SSNM



The Context

The
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Research

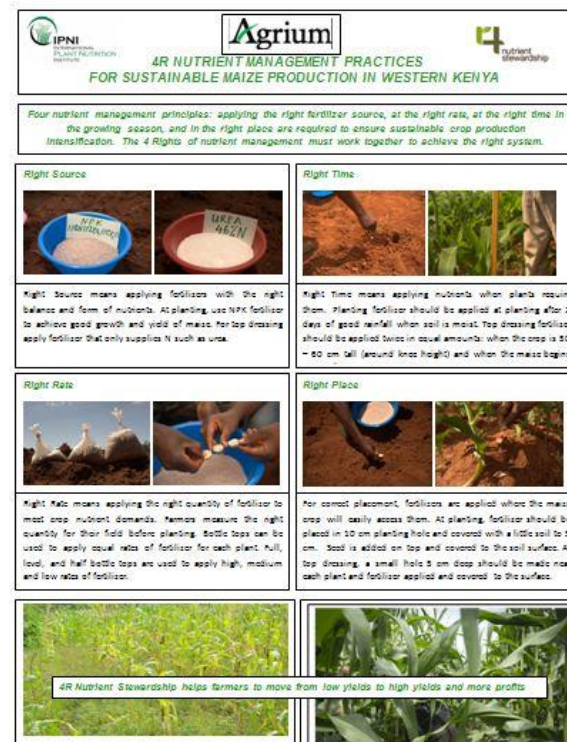
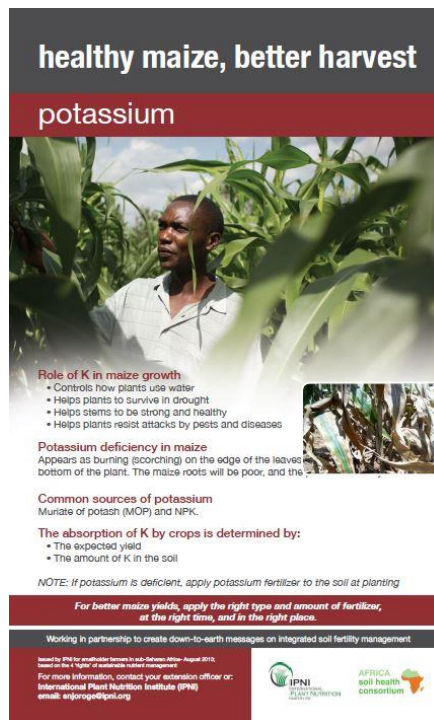
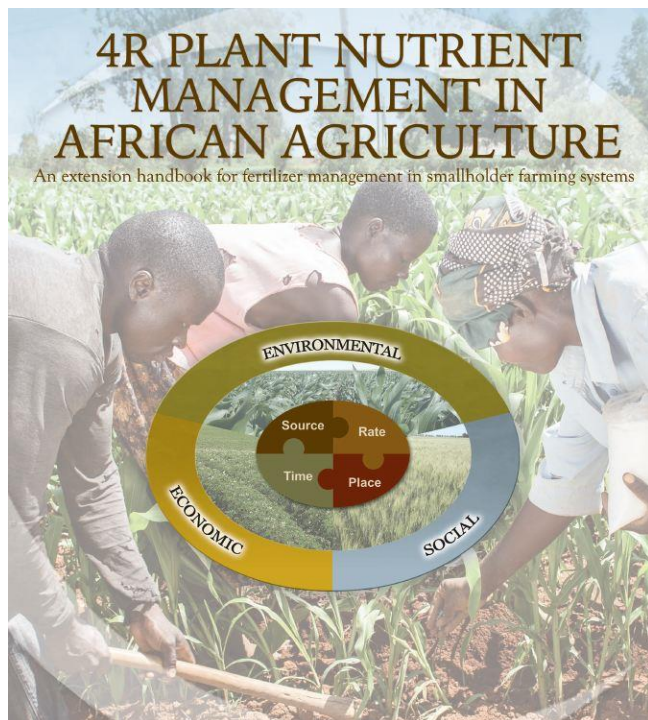
Dissem-
ination

Capacity
building

Impact

4R Knowledge Products

Developed and disseminated in partnership with CABI, MOA, Researchers in SSA, and Agrium



The Context

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Research

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Capacity
building

Impact

Capacity building and policy engagement

- Field-based farmer training
- Training of extension workers in partnership with MOA, KARI, OneAcrefund, MVP, and County government
- Training of Msc students in partnership with local universities
- Engagement with policy makers during project activities
- Partnership with seed and fertilizer companies



The Context

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framework

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ination

Capacity
building

Impact

Impact and highlights of the project

- Regional recognition of 4R Nutrient Stewardship
 - CABI, IITA, CIMMYT, CGIAR-MAIZE, AGRA
- Policy influence: Western Kenya County Government diversified fertilizer procurement from DAP to include NPK
- 4R activities and outputs have attracted additional projects such as the Kenya Cereals Enhancement Program (KCEP)
- Project activities have received national media outreach through print, radio and television media

The Context

The
framework

Research

Dissem-
ination

Capacity
building

Impact



INTERNATIONAL
PLANT NUTRITION
INSTITUTE

ISSUE REVIEW

Ref #17023

4R Phosphorus Management Practices for Major Commodity Crops of North America

By Tom Bruulsema, Phosphorus Program Director, IPNI

March 2017

Phosphorus plays a crucial role in sustainable crop production. Made from finite natural resources, phosphorus fertilizers support high and increasing crop yields, but their use can also elevate the risk for reduced water quality. Increasing the adoption of 4R phosphorus application practices—applying the right source at the right rate, right time, and right place—has great potential to improve both crop yields and water quality. This paper reviews a science-based effort to describe such practices for five major commodity crops produced in North America.

<http://phosphorus.ipni.net/>

Summary

1. Phosphorus sustainability issues are addressed by industry initiatives implementing 4R Nutrient Stewardship.
2. The Lake Erie Watershed 4R program built public trust by engaging eNGOs, agri-retailers, and farmers.
 - Further progress depends on continued research, adaptive management, and practice changes
3. The Africa 4R program proved successful in disseminating nutrient management knowledge.
 - Further interventions required at policy level to strengthen extension, reduce farm gate fertilizer prices, and improve farmer access to markets for their crops.

