The 4R Research Fund was established by the fertilizer industry to help determine sustainability indicators and environmental impact data for implementation of 4R Nutrient Stewardship across North America. The fund provides needed resource support with a focus on measuring and documenting the economic, social and environmental impacts of 4R Nutrient Stewardship.

More at:

http://nutrientstewardship.com/funding
or
http://info.ipni.net/4R-ResearchFund

The Fertilizer Institute
Nourish, Replenish, Grow

IPNI
International Plant Nutrition Institute

Fertilizer Canada

META-ANALYSES

Meta-analysis of Enhanced Efficiency Fertilizers in Corn Systems in the Midwest

There is considerable interest in enhanced efficiency fertilizers (EEFs) as a component of 4R Nutrient Stewardship, but their impact on yield and environmental quality is not well documented. This analysis found a small, but positive effect of EEFs on corn yield in the U.S. Midwest. None of the products was consistently superior to others. Splitting N fertilizer applications had a greater positive impact on corn yields than the EEFs. During extreme weather events there is a greater likelihood of a yield response to the EEFs. The time of fertilizer application has a greater positive benefit than the N fertilizer source. Nitrification inhibitors generally reduce nitrous oxide (N_2O) emissions, but their effect on nitrate (NO_3^-) leaching was not discernible due to inadequate scientific literature.

Nitrogen Losses: A Meta-analysis of 4R Nutrient Management in U.S. Corn-Based Systems

Few studies simultaneously examine nitrous oxide (N_2O) gas loss and nitrate (NO_3^-) leaching to groundwater in corn fields, making it difficult to generalize 4R practices that minimize both fertilizer loss pathways. Nitrogen fertilizer source has a large influence on N_2O emissions, with anhydrous ammonia the most susceptible to loss. Inhibitors can make an important contribution to reducing N_2O emissions. Urea-containing fertilizers generally have lower NO_3^- losses than ammonium-based materials. Applying N fertilizer while the crop is growing reduces NO_3^- losses by half, compared with pre-plant applications. Regional differences necessitate additional research to gain the full benefits of site-specific 4R implementation.

Meta-analysis of Phosphorus Fertilizer Placement and Tillage Interaction for Corn and Soybean in the U.S.

The literature analysis of effects of fertilizer P placement and tillage showed no significant yield differences between banded or broadcast applications for corn and soybean in the U.S. Midwest. Band placement of P fertilizer sometimes provides a yield boost when soil P concentrations are low or when a relatively small amount of fertilizer is applied (<40 lb P_2O_5/A). Placing the fertilizer P beneath the soil surface may provide a benefit in reducing P loss in runoff water.

Assessing the Effects of Conservation Practices and Fertilizer Application Methods on Nitrogen and Phosphorus Loss from Farm Fields: A Meta Analysis

The MANAGE model (Measured Annual Nutrient loads from AGricultural Environments) was developed to provide a comprehensive database of field-scale nutrient export information. The model is currently being updated with the latest scientific information on nutrient loss from agricultural fields. The new up-to-date model will allow users to more accurately predict the effects of 4R Nutrient Stewardship practices on potential losses from a variety of crops.

A "MANAGE"ed Approach for 4R Nutrient Stewardship on Drained Land

The extent of improvement in water quality following adoption of 4R nutrient management practices in drained land is not clear. Conclusions from this study clearly demonstrate that years with more precipitation result in more drainage and greater N and P loads in drainage water. Nutrient loads in water also increase at higher N and P fertilizer application rates, but additional N and P also increase crop yields. This inverse relationship between nutrient load and crop yields demonstrates the balance between production and environmental goals. The influence of Right Time and Place on water quality was not clear from the available data, but these agronomic practices are known to be important for meeting agronomic and environmental goals.

Right Source

Right Rate

Right Time

Right Place

RESEARCH FUND

4R Nutrient Stewardship

RESEARCH FUND

PROGRESS TO DATE
September, 2015

RESEARCH AND DEMONSTRATIONS

1 Improving Nitrogen Management Tools for Reduced Environmental Losses from Corn Production

Documenting potential improvements of nitrogen efficiency by adopting 4R management techniques for corn production with field experimentation and synthesis of existing data. A survey of on-farm data from local farmers participating in on-going 4R programs allows analysis of the effectiveness of current 4R practices. New field data is used to refine a simulation model to predict the fate of N in agricultural fields. [Guelph, Ontario]

2 Improved Nitrogen Application Methods and Nitrogen Sources for Corn in Southwestern Ontario

Understanding how 4R stewardship can compensate for the need to quickly apply N fertilizers prior to spring planting while improving efficiency. The urgency to rapidly plant and fertilize crops in the spring when weather conditions become ideal has complicated farmer decisions. Using 4R principles for N fertilizer management can improve corn yield, while reducing greenhouse gas and ammonia emissions. [Woodslee, Ontario]

3 Optimization of 4R Nitrogen Fertilization Practices in Response to Production System Uncertainties

Quantifying the influence of soil and weather on crop yield and potential N fertilizer loss. In this scientific review, datasets are being collected and combined to determine how factors such as precipitation, temperature, and season of year can be included in implementation of 4R practices. [St. Jean, Quebec]

4 Can Foliar Urea Reduce Nitrogen Losses from Potato Production in Atlantic Canada?

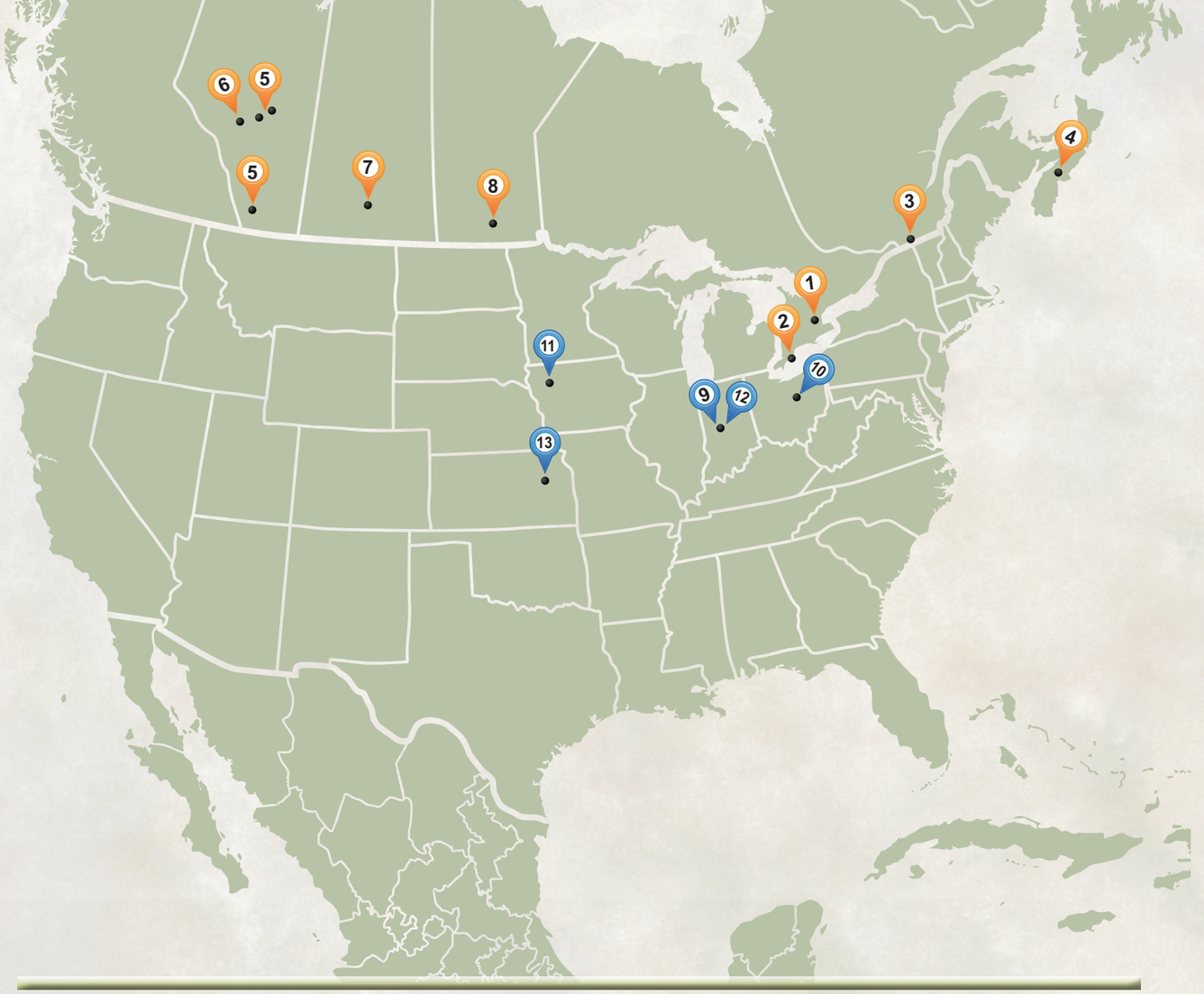
Spraying potato leaves with a urea-containing solution might allow farmers to reduce the amount of N fertilizer applied to the soil. Potato yields, N leaching, and greenhouse gas emissions are being measured in potato fields receiving combinations of foliar and soil-applied N. [Nova Scotia]

5 Nitrogen Stabilizers to Enhance Nitrogen Use Efficiency and Reduce Greenhouse Gas Emissions

Determining how urea fertilizer stabilizer additives applied to spring wheat increases yield and quality, while reducing gaseous and leaching losses of N. [Lethbridge, Edmonton, and Devon, Alberta]

6 Coordinated Nitrogen and Sulfur Management in Sulfur-deficient Soils

Fertilizing with both N and S has been linked to increased crop yields and reduced emissions of greenhouse gas. The long-term Breton Classical Plots (established in 1930) are being used to measure the impact of fertilization practices on nitrous oxide emissions from soil. [Breton, Alberta]



7 Effect of Broadcast versus Banded Phosphorus Application on Fate of Applied Phosphorus in Soil and in Snowmelt Water Flow

Placing P fertilizer in close proximity to soybean seeds may boost crop yield and reduce losses in water runoff. Fertilizer placement and the time of its application for soybean production is under investigation. Loss of soluble P in snowmelt water from frozen soil, and during spring-thaw is also being measured. [Central Butte, Saskatchewan]

8 Enhanced Efficiency Fertilizer Technologies to Reduce Nitrous Oxide Emissions from Cropped Soils in Prairie Canada

Applying anhydrous ammonia is popular due to its low cost, but complications arise from field operations. New application equipment allows a variety of fertilizer additives to be used with anhydrous ammonia, which may improve efficiency. Precision fertilizer placement techniques, rates of N conversion by soil microbes, and agronomic efficiency from fall-applied ammonia are being measured. [Univ. of Manitoba]

9 4R Fund Research Repository

Developing an information repository to preserve the data from all 4R Fund projects in a standardized way for future reuse. The research repository and framework will ensure that research data are standardized across projects, widely accessible, and archived for long-term preservation and reuse. The database is housed within the Purdue University Research Repository. [Purdue, Indiana]

10 Evaluating the 4R Nutrient Stewardship Concept and Certification Program in the Western Lake Erie Basin

Monitoring the impacts of 4R Nutrient Stewardship on crop productivity, profitability, nutrient loss, and water quality. The impacts of 4R adoption on the Western Lake Erie watershed are being measured and modeled. Follow-up surveys of farmers and crop advisors will guide future educational efforts for promoting widespread 4R adoption. [Ohio]

11 Impacts of 4R Nitrogen Management on Crop Production and Nitrate-Nitrogen Loss in Tile Drainage

Reducing nitrate leaching losses to tile drainage can be achieved by implementing 4R-based practices for corn production. The field site has an instrumented tile drainage system that allows analysis of water flows and nutrient composition under 4R-managed fields. This provides a direct link between 4R practices and water quality measurements from fields hydrologically linked to the Mississippi River. [Sutherland, Iowa]

12 Supplemental Late-vegetative Nitrogen Applications for High-yield Corn: Agronomic, Economic and Environmental Implications with Modern Versus Older Hybrids

Developing 4R fertilizer recommendations for modern corn hybrids requires understanding if they are more responsive to very late vegetative N applications than older varieties. Various fertilizer rate and timing combinations are being studied to measure crop performance and nutrient efficiency. [Purdue, Indiana]

13 Minimizing Phosphorus Loss with 4R Stewardship and Cover Crops

Planting winter cover crops have the potential to increase corn and soybean yields, while minimizing P loss. Eighteen instrumented watersheds allow collection of runoff water from plots receiving various P fertilizer management practices and with winter cover crop treatments. [Manhattan, Kansas]