



**Farmer-Funded Research:
Maximizing Yields. Minimizing Losses.**

Who is Illinois NREC?



**Created in 2012
through state statute**



**Funded by \$.75/ton
assessment on
fertilizer sold in
Illinois**



**Collaboration
between ag,
environmental
groups, and state
agencies**

- Pursue nutrient research & educational programs
- Ensure adoption and implementation of practices that
 - Optimize nutrient use efficiency
 - Ensure soil fertility
 - Address Environmental concerns regarding fertilizer

Who is Illinois NREC?

- 13 Member Council (9 voting and 4 advisory)
- Voting Members
 - 3 Farmers (ILFB, ICGA, ISA)
 - 3 Members from Fertilizer Industry
 - CCA
 - Specialty Fertilizer
 - Illinois Department of Ag
- Advisory Members
 - 2 Environmental Organizations (Sierra Club & Environmental Law Policy Center)
 - State/Federal Ag Research Station Representative
 - Illinois EPA

Illinois NREC Research Funding



Solicit proposals that focus on

Improved nutrient efficiency
Enhanced crop production
Protect water quality



Council, Research Committee, and Independent Peer Review Team review applications



Projects are ranked on merit and availability of funds

Funding and Progress to Date

- Since 2013
 - Just shy of **\$31M** invested in research projects
 - Four NREC publications: Turf Guide, Cover Crop Guide 1.0, Guide to MRTN, and Cover Crop 2.0
 - Annual Reports, Investment Insights, Field Notes, videos, Research Forum
 - Nearly two dozen papers published in Professional Journals written by NREC-funded researchers
 - Many opportunities for collaboration on research and outreach projects

NREC and Illinois' Strategy

↔ Work in parallel (but independently) with the strategy

✓ Evaluate removal rates for BMP's already in strategy

🔍 Provide peer-reviewed research for BMP's not already in strategy

🤝 Serve on Policy Working Group, and Ag Water Quality Partnership with support to Science Advisory Team

💰 Fund bi-annual USDA-NASS Survey re: NLRs awareness and adoption

2021/22 Research Priorities

- Continue studies testing the impact of N management systems on efficiency of N use.
 - a. Maintain statewide distribution of work on optimum N rate to meet the needs of the MRTN.
 - b. Evaluate the efficacy of combinations of (4R's) source, place, rate and time of application on N efficiency.
 - c. Synergistic approaches to 4R's including utilization of macro/micronutrients to improve N efficiency
- Cover Crop Systems: Evaluate the economics, feasibility, water quality impacts and best management practices of growing cover crops to address nitrogen and phosphorus loss as well as crop productivity. Proposals should address all aspects of cover crops from crop selection, seeding and grazing through crop termination and subsequent mineralization and nutrient release.
 - a. Cover Crop systems following soybeans and ahead of corn to maximize corn production and minimize nutrient losses.
 - b. Engineered cover crops/Cover crop options beyond cereal rye.
 - c. Addition of wheat to corn/soybean rotation to increase nutrient utilization
- Evaluate the agronomic and environmental benefits of reduced tillage/strip till/erosion control and the placement, timing and rate of nutrient applications throughout the entire state.
- Phosphorus – Continue studies testing the impact of Phosphorus management systems on efficient Phosphorus usage, the role of legacy Phosphorus, as well as placement and timing of Phosphorous applications in corn and wheat.
 - a. Conduct a literature review on the body of research related to phosphorus transport in streams associated with streambank and streambed erosion at the watershed scale.
- NREC is also very interested in research projects that go beyond the “known” into more innovative (novel, inventive, original) and forward-looking research. This could include edge-of-field practices.

2022 Research

- \$3.9 Million in research awards
- 28 total projects
 - 22 ongoing
 - 6 new
- Grants recipients:
 - University of Illinois
 - Southern Illinois University – Carbondale
 - Purdue
 - Western Illinois University
 - IFCA

4R NUTRIENT MANAGEMENT



4R Nutrient Management

- Ongoing N-rate trials to support the MRTN
- Impact of timing on tile nitrate levels
- The role of mineralization and nitrate loss from 0 nitrogen trials
- 4R Nutrient research focus is both agronomic, economic and environmental
- Precision Ag for N-Management
- N placement
- Using stable isotopes to understand sources and cycling of nitrates



RIGHT SOURCE

Matches fertilizer type to crop needs.



RIGHT RATE

Matches amount of fertilizer type crop needs.



RIGHT TIME

Makes nutrients available when crops needs them.



RIGHT PLACE

Keep nutrients where crops can use them.

“Nitrogen Placement and Application Timing for Best Efficiency, Growth, and Yield of Corn across Illinois.”

Project Goal: Maximize N use efficiency of corn through Illinois through optimum fertilizer placement, rates, and timing while maintaining or increasing grain yield and limiting N loss to the environment.

- *Fred Below and Eric Winas (UIUC)*

PROGRESS:

- Concentrating N fertilizer below ground near the crop row can increase grain yield and N removal
- The biggest N fertility factor for increasing yield potential is having adequate N available at the start of the growing season.
- Applying in a band near the crop row will allow for maximum N availability

* This data is still preliminary, and a final report will be available in 2022

“Nitrogen Management Systems in Tile-Drained Fields”

Project Goal: To add to the understanding of when and how N is lost via tile in corn and soybean rotations. It looks specifically at evidence of tile N loss during the non-growing season, especially following soybean.

- *Lowell Gentry UIUC*

PROGRESS:

- Nitrate from soil mineralization contributes nearly 50% to the tile nitrate load – explaining that soybean production is an important source of tile nitrates – overwintering cover crops can limit this loss
- 100% Fall N applications are significantly “leakier” than spring and side-dress N applications and while they may not have a negative yield impact, they DO greatly contribute to tile N loads
- Cool temps in April and May appear to exert great control on the overall magnitude of tile nitrate loss in a year.
- Tile Nitrate loads are NOT SIMPLY a matter of over-fertilization

* This project is in its 7th year of funding

4R Projects to Watch

“Towards Management of Dissimilatory Nitrate Reduction to Ammonium for Nitrate Retention”

- Explores DNRA as an alternative nitrate reduction pathway when reduction via denitrification has been inhibited by the presence of oxygen

“Precision Nitrogen Management for Improving Farm Profitability and Water Quality in Southern Illinois”

- Goal: generate an algorithm for Illinois farmers for a targeted Nitrogen rate recommendation and also evaluate currently available N rate tools

A wide-angle photograph of a flat agricultural field, likely a cover crop field, under a clear blue sky. The field is covered in green vegetation and dry, brown plant matter. A person is visible in the distance, standing in the field. The text "COVER CROPS" is overlaid in large, white, serif capital letters on the left side of the image.

COVER CROPS

Cover Crop Research

- Long-term paired watershed research
- N application timing and cover crops impact on Fate and Availability of N Fertilizer
- Extended rotation with cover crops
- Insect management in cover crop systems
- Utilizing cover crops in Southern Illinois for P and N loss
- Modeling projects to evaluate the suitability and benefits of cover crops
- Integrating grazing into cover crop systems

“A Long-term Evaluation of N Application Timing and Cover Crops Impacts on the Fate and Availability of N Fertilizer and Crop Production on Tile Drained Fields.”

Project Goal: Utilize N15 methods to identify whether cover crops primarily take up soil or fertilizer N. And determine the synchrony of the timing and quantity of cover crop residue N release and corn and soybean N demand.

- *Shalamar Armstrong (Purdue)*

PROGRESS:

- On average, approximately 60 lbs/Acre of N is scavenged in the cereal rye above-ground biomass. Only 10% of that biomass N is used by the subsequent cash crop
- Growing cereal rye in the fallow period generates a larger capacity for fertilizer to be applied without the result of greater N loss via tile drainage
- Over a 5 year study period, the adoption of a cereal rye based cover crop resulted in a 44% nitrate loss reduction over the non-cover crop control.

* This project has been the subject of several peer-reviewed scientific publications

“Cereal Rye ahead of Corn: Evaluating Nitrogen Catch and Release.”

Project Goal: learn how to best manage cereal rye as a winter cover crop before corn in either a corn/soybean rotation or in continuous corn.

- *Lowell Gentry, Emerson Nafziger, Dan Schaefer, Eric Miller, Greg Steckel, Nick Seiter (UIUC, IFCA)*

PROGRESS:

- Front loading all the fertilizer N in early Spring may help to overcome the reduction in plant available N to a corn crop following cereal rye
- A 6% corn yield loss was indicated when cereal rye biomass was greater than 0.5 ton/acre and when corn was planted within 2 weeks of termination
- Keep biomass to less than 0.5 tons/acre and allow at least two weeks between termination and corn planting

“Minimizing P and N loss from Agricultural Systems with Cover Crops and Tillage in Southern Illinois.

Project Goal: Assess the long-term impacts of cover crops under conventional tillage and no-till on nutrient leaching

- *Karl Williard, Jon Schoonover, Amir Sadeghpour, Karla Gage, Dwight Sanders (SIU-C)*

PROGRESS:

- Cereal Rye-Soybean-Hairy Vetch-Corn exhibited 82% less N leaching compared to non-cover crop control
- Cereal Rye-Soybean-oats/radish-corn exhibited 68% less N leaching
- Phosphate leaching was significantly higher in rotations under conventional tillage compared to no-till
- Cover crops reduce erosion by providing dormant season ground cover and reduce runoff by increased evapotranspiration and soil infiltration rates.

Cover Crop Projects to Watch

“Integrating livestock grazing into the western Illinois corn-soybean cropping system to enhance farm profitability and reduce nutrient loss”

“Next Generation Cover Cropping in Corn-Soybean Rotation to Improve Farm Benefits and Decrease Environmental Losses in South and Central Illinois

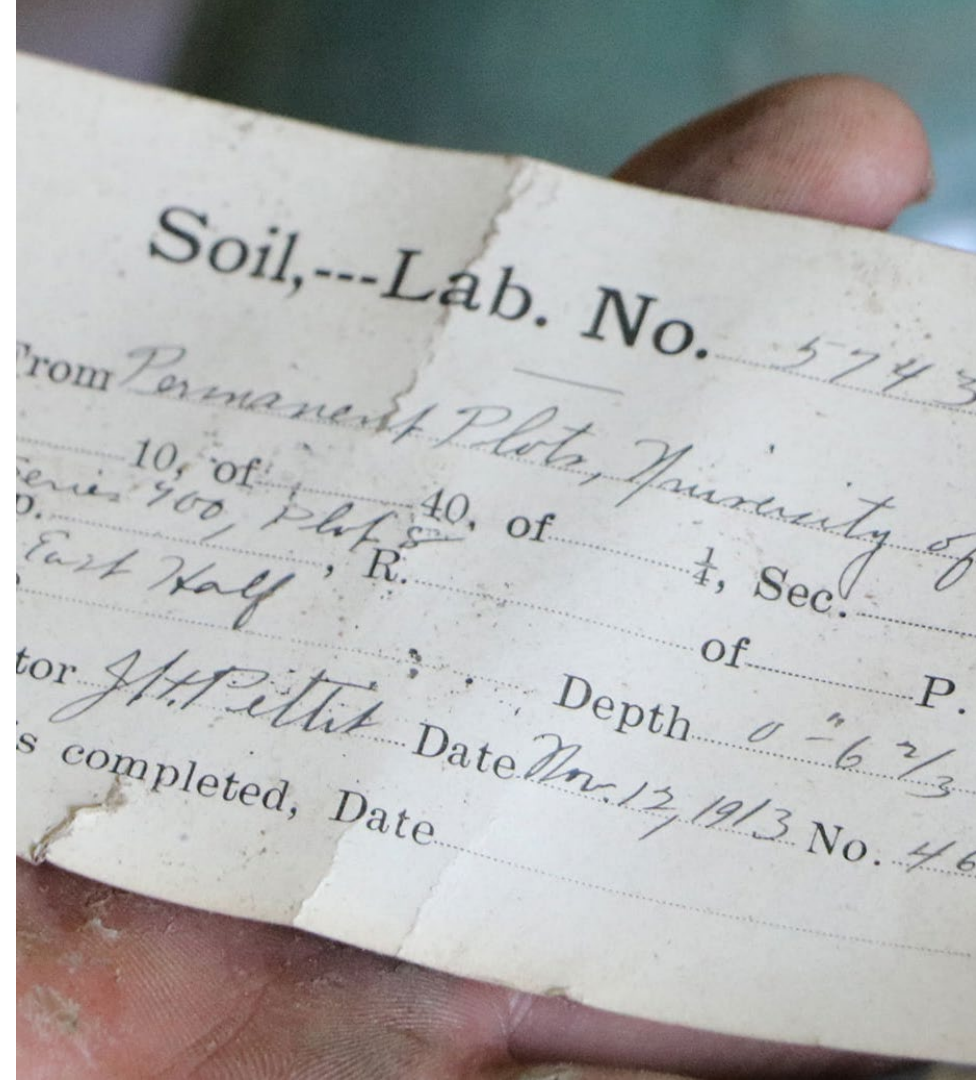
Check out the Cover Crop Decision Tool at:
<https://covercrop.ncsa.illinois.edu/>



PHOSPHORUS RESEARCH

Phosphorus Research

- Struvite made from recycled P from wastewater treatment facilities as an alternative P Source
- Edge of Field P Filters
- Designer BioChar for P removal
- The role of legacy P and utilizing 150 years of soil samples
- Evaluation of WASCOB's P Removal Potential
- Role of Gypsum in managing P losses



“Understanding Mechanisms and Processes of Dissolved Reactive Phosphate (DRP) Loss in Illinois Tile-Drained Fields”

Project Goal: Evaluate factors influencing the seasonal distribution and movement of DRP in tile drainage systems. (DRP is P that is found in solution as opposed to being attached to soil particles)

- *Yuji Arai, Lowell Gentry, Jennifer Fraterrigo, Dan Schaefer, Louis Andino (UIUC, IFCA)*

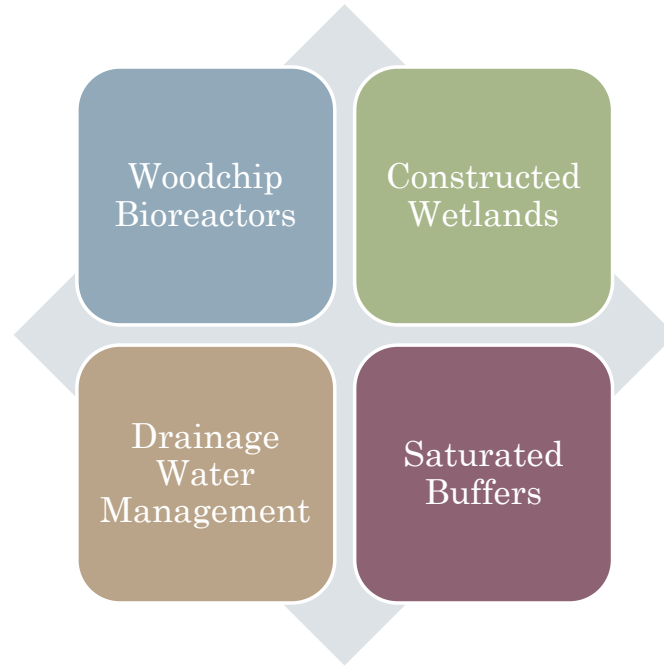
PROGRESS:

- Low spots accumulate soil-bound P but the laterals located under these large low spots transport water with higher DRP
- The low spots have larger P deposits and often lower crop removal due to stunted or drowned out crops
- Both historical and recent management have led to increased soil P concentrations
- There is a need to draw down soil P to concentrations that do not exceed the crop requirements.

A group of approximately 15-20 people, mostly men in casual attire like jeans and t-shirts, are standing in a field. They are gathered around a long, narrow trench that has been dug into the ground. The trench is covered with white plastic mulch, which is partially buried under dark, rich soil. The surrounding field appears to be a cornfield, with tall corn stalks visible in the background. The scene is outdoors, and the lighting suggests it might be late afternoon or early morning. The overall image conveys a sense of a field demonstration or educational activity related to agricultural practices.

EDGE of FIELD PRACTICES

Edge of Field Practices



A topographic map is displayed within a wooden frame. The map features contour lines and color-coded elevation zones in shades of blue, green, and brown. A prominent mountain peak is visible in the upper center. The text "EMERGING ISSUES" is superimposed in a large, white, serif font across the middle of the map.

EMERGING ISSUES

Emerging Issues

- Tile Depth and Spacing
- White paper research related to P loading in Illinois River watershed
- Maize microbiome research
- P-Loss from Streambanks and streambeds
- Integrating Tillage, Soil Carbon Dynamics, and Tile N Loss

Where can I get more info?

- **Website:** illinoisnrec.org
- **Twitter:** @IllinoisNREC
- **Facebook:** @IllinoisNREC
- **Email:** Julie@illinoisnrec.org or sgolovay@illinoisnrec.org



Make plans to join
us in Champaign on
February 16, 2022