Iowa Nutrient Research Center

An Iowa Board of Regents Center

Iowa Nutrient Research Center Update to WRCC September 11, 2015

John D. Lawrence

Interim Director

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Overview

- Brief history
- Projects funded
- How to track projects
- Highlights
- Summary and future plans

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Brief history

- The Iowa Nutrient Research Center was established by the Iowa Board of Regents in response to legislation passed by the Iowa Legislature in Spring 2013.
- Initially funded at $1.5 million, renewed at $1.325 million and now in third year

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Brief history

- *Shall establish in Ames as part of Iowa state university of science and technology an Iowa nutrient research center.*
- *The center shall be administered by a director who shall be appointed by the dean of the college of agriculture and life sciences of Iowa state university of science and technology.*
- *The center shall facilitate collaboration among appropriate institutions of higher education governed by the state board of regents, including but not limited to institutes, departments, and centers.*

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Purpose

- *The purpose of the center shall be to pursue a science-based approach to nutrient management research that may include but is not limited to evaluating the performance of current and emerging nutrient management practices, and using an adaptive management framework for providing recommendations for the implementation of nutrient management practices and the development of new nutrient management practices.*

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Advisory Council

- The dean of the college of agriculture and life sciences at ISU.
- The director of the ISU extension service.
- A representative of the IIHR - hydroscience and engineering of the university of Iowa
- A person knowledgeable in an area related to nutrient research appointed by the president of UNI.
- A person knowledgeable in an area related to nutrient research appointed by the state association of private colleges and universities.
- The secretary of agriculture.
- The administrative director of the soil conservation division of the department of agriculture and land stewardship.
- The director of the department of natural resources.

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Funding process

- RFP based on legislation and investigator discussions at summit
- Request for proposals sent to 3 institutions
- Brief proposal with quick turn around
- Review panel scores proposals independently and then they discuss and recommend

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Funded projects 2013

- Social-Economic Research Work Plan: Kling, Wright Morton, Arbuckle, Ingels
- Iowa Institute of Hydraulic Research (IIHR) - Hydroscience and Engineering Work Plan: Schnoebelen, Weber, Ward.
- Distribution, Transport, and Biogeochemical Transformations of Agriculturally Derived Nitrogen and Phosphorus in Cedar River Watershed : Iqbal.
- Investigating Causes of Corn Yield Decreases Following Cereal Rye Winter Cover Crop: Kaspar, Moorman, Robertson, Lenssen.
- Establishing Pragmatically Dynamic Program for Extending Water Quality BMP Financial Information: Farmer Tools for Iowa Nutrient Reduction Strategy : Tyndall. Iowa State University
- Phosphorus Transport in Iowa Streams: Importance of Stream Bed and Bank Erosion: Isenhart, Kovar, Schilling, Schultz, Thompson, Tomer
- Establishment and Monitoring of Saturated Buffers within High–Priority HUC–12 Watersheds: Jaynes, Isenhart.
- Nonpoint Source Nitrogen and Phosphorous Loads at Implementation Scale: Direct Agricultural Nutrient Loads to Surface Waters in Relation to Land Use and Management: Crumpton, Helmers, Schilling, Tomer, Mallarino.
- Impacts of Cover Crops on Phosphorus and Nitrogen Loss with Surface Runoff: Mallarino, Cruse, Helmers, Sawyer, Jaynes.
- Bioreactor Research and Assessment of Woodchip Tile Denitrification Bioreactors: Optimal Design/Performance and Experimental Bioreactor Installation and Study: Soupir and Wolf.

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Funded projects 2014

- Drainage Water Quality Impacts of Current Future Agricultural Management Practices: Helmers, Soupir, Mallarino, Pederson.
- Nutrient Trading in Iowa: A Pilot Study in the Catfish Creek Watershed: Weber, Drake.
- Prairie Seed Mixes for Contour Buffer Strips: On-Farm Demonstration and Workshops : Smith.
- Developing Remote Sensing Protocols for Inventory of Permanent Vegetative Practices : Giglierano, Logan, Porter, James, Isenhart.
- Measuring the Effectiveness of Stacked Nutrient Reduction Practices: Schilling, Almitra, Schnoebelen.
- Scientific and Technological Tools to Implement Iowa Nutrient Reduction Strategy : Schnoebelen, Weber, Ward.
- Stream Nitrate Trends Affected by Farming Practices in the Walnut Creek Watershed: Peters and Jaynes.
- Phosphorus Loss from Ephemeral Gully Formation and Sediment Transport : Cruse, Hurley, Mallarino, Helmers.
- Modeling of Nitrate Loads and Concentrations in the Raccoon River: Villarnini, Anderson, Jones, Schilling.
- Developing Remote Sensing Protocols for Inventory of Nutrient Management Practices: Gelder, Porter, Kaleita, Wolter, Cruse, Isenhart, Tomer, Wolter, James.

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Funded projects 2015

- Reducing nutrient losses while increasing farm profit through precision conservation: VanLoocke, Heaton, Muth, Schulte-Moore, Archonotoulis, Gronstal-Anerson
- Quantifying temporal and spatial variability in No3-N leaching across Iowa: Archontoulis, Helmers, Castellano, Kyveryga, Keil, Wolf
- Identifying and Quantifying Nutrient Reduction Benefits of Restored Oxbows: Schilling, Young, Jones, Kult, Wilke
- Work Plan for INRC, IIHR-Hydroscience & Engineering: Weber
- Evaluation of Stacked Conservation Practices on P and Sediment loss: Cruse, Herzmann, Gelder, Kalita, McNeely, Logan, Isenhart, Walter
- Quantification of Nutrient Reduction Practices Benefits from the Hillslope to the Watershed Scale: Arenas, Shilling, Weber
- Water Quality Performance of Prairie Strips: Helmers, Sutphin, Seeman
- Impacts of Cover Crops on P and N loss with surface runoff a project continuation request: Mallarino, Helmers
- Cover crops Influence Nutrient Cycling, Yield and Diseases of Corn and Soybeans: Robertson, Leandro, Lenssen, Kaspar, Moorman
- Woodchip Bioreactors for Improved Water Quality: Soupir, Hoover, Moorman, Isenhart
- Linking nutrient reduction practices with biomass energy: quantifying thermal energy demand and supply capacity from representative farms in eastern Iowa: Jackson, Enshayan

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Progress Reports

Investigating Causes of Corn Yield Decreases Following Cereal Rye Winter Cover Crop

Investigators: Kaspar, Moorman, Robertson, Lenssen. USDA-ARS and Iowa State University
Project PDF: cerealrye.pdf

Investigating Causes of Corn Yield Decreases Following Cereal Rye Winter Cover Crop Updates

Mar 2015

A field experiment examined corn growth and yield when a cereal rye cover crop was terminated at 25, 14, 10, or 3 days before planting, or one day after planting, compared with corn without a rye cover crop. Corn was harvested in October with an instrumented combine to determine grain yield. Rye terminated 10, 14 or 25 days before corn planting did not significantly reduce yield. However, grain yield of the rye treatments terminated three days before corn planting and one day after planting were significantly less than the no-cover-crop treatment. Another four treatments examined corn seed planted three days after terminating rye with and without seed fungicides. Preliminary conclusions are that current seed treatments are not effective on corn root infections following cereal rye cover crops. Rye cover crop plots were established for field experiments in 2015.

Dec 2014

Both controlled environment chamber and field experiments are underway to study cover crop management techniques. Current controlled environment experiments are examining the difference in corn growth and root infection of seedlings following plants killed with glyphosate herbicides and those killed by clipping the plants below the crown at different times. Field experiments continue with measurements of plant growth stages and plant population taken at multiple dates. Whole plant samples were harvested to determine above-ground biomass and ear weight, cob weight, seed weight, kernel number and weight per seed. Stalk rot evaluations also were made at plant maturity.

Sep 2014

To study cover crop management techniques, two field experiments were laid out and planted with rye cover crops in October 2013. The first compared corn seed treated with a combination of several seed fungicides with untreated corn seed in plots with and without a rye cover crop. The combined fungicide seed treatment also was tested in a controlled environment chamber experiment conducted over the winter. The second experiment compared treated corn seed planted without a cover crop to corn planted after a cereal rye cover crop killed at planned intervals before corn planting. In both field experiments, corn percent emergence, root rot ratings, root pathogen isolation and

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Progress Reports

Investigating Corn Yield Decreases Following Cereal Rye Winter Cover Crop

Issue: In Iowa, lack of experience with cover crops and the predominance of the corn-soybean rotation, late harvests, early planting and long cold winters have limited adoption of cover crops. The Iowa Science Assessment of Nonpoint Source Practices identified cover crops as an effective means of reducing the transport of nitrate and phosphorus from row cropland. Future research needs included cover crop management techniques adapted to Iowa to limit the risk to corn yield reduction.

Objective: Although work on other potential cover crops is underway, winter cereal rye currently is the only species known to consistently grow well enough statewide to provide water quality benefits. For farmers, a drawback from considering use of winter rye or other grass cover crops is that occasionally they can cause a corn yield decrease the following year.

One potential cause of lower yields is a decrease in corn population or plant vigor caused by soil-borne fungal pathogens. This may occur because grass cover crops can be hosts for some of the same pathogens that infect corn seedlings. After herbicide treatment, pathogen populations may increase rapidly on the roots of the dying cover crop plants. If corn is planted soon after grass cover crops are terminated, the soil inoculum levels of these pathogens will be very high just as the corn is germinating and emerging. If environmental conditions are favorable for the pathogens to infect corn plants (i.e. cold and wet), these pathogens may reduce plant population, slow and reduce growth and decrease final yield. When planting conditions are warm and dry, or when background inoculum levels are low, the pathogens may have little or no effect.

Approach: Controlled-environment lab studies will be conducted under cold, wet conditions that should enhance infections. Field experiments will be planted as early as possible, to increase the likelihood of cold, wet soil conditions. Management practices such as seed-applied fungicides and timing of cereal rye termination before corn planting will be examined to see how those affect soil pathogens, corn growth and yield.

Investigators:

Tom Kaspar
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USDA-ARS National Laboratory for Agriculture and the Environment

Tom Moorman
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Alison Robertson
Associate Professor, Plant Pathology & Microbiology
Iowa State University

Andrew Lenssen
Associate Professor, Agronomy
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Title
Issue:
Objective:
Approach:
Investigators:

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Highlights: Impacts of Cover Crops on Phosphorus and Nitrogen Loss with Surface Runoff

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Highlights: Bioreactor Research and Assessment of Woodchip Tile Denitrification Bioreactors: Optimal Design/Performance and Experimental Bioreactor Installation and Study

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Highlights: Phosphorus Loss from Ephemeral Gully Formation and Sediment Transport Updates

- 12 STRIPS watersheds
- Data from 570 soil samples analyzed and matched collated to their sampling location.
- A method of calculating the estimated gully channel volume has been designed.
- The next step is to run the calculations across all 12 of the gully channels.

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Highlights: Nutrient Trading in Iowa: A Pilot Study in the Catfish Creek Watershed Updates

- Project is in the latter stages of model development and the beginning phase of model calibration.
- Model development has involved data inventory of the watershed, terrain preprocessing in GIS and gathering the necessary model input datasets.
- Two water quality and stream stage sensors deployed in the watershed will allow comparison of simulated and measured flow and water quality variables.

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Highlights: Distribution, Transport, and Biogeochemical Transformations of Agriculturally Derived Nitrogen and Phosphorus in Cedar River Watershed Updates

- Interpreting data from year 1 water sampling, and are developing sub-watershed maps around each sampling site.
- Focusing on nutrient load calculations for the sub-watersheds using GIS mapping tools.
- Eight new sites have been chosen for sampling in 2015.

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Summary and future plans

- Good projects submitted
- Range of topics consistent with Center purpose
- Mix of short term and longer term projects
- Leverage to other funding
- Progress reported and posted
- Will post impact statements as projects finish

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