

Midwest Cover Crops Council
Indiana Report for March 14-15, 2017 Meeting in Grand Rapids, MI

Contact Information		MCCC State Contact	NCCC-211 Official State Representative
Name:	Eileen Kladivko	Purdue University	Shalamar Armstrong
Organization:	Purdue University	Purdue University	Purdue University
E-mail:	kladivko@purdue.edu	kladivko@purdue.edu	sarmstro@purdue.edu
Telephone:	765-494-6372		765-496-0256

Highlights

Hiring of MCCC Program Manager Anna Morrow, July 1, 2016!

Two new Extension publications

- Kladivko, E., B. Fisher, and L. Brown. 2016. Agricultural tile drains clogged with cover crop roots? <http://www.ag.purdue.edu/agry/extension/Documents/TilesandCoverCropRoots.pdf>
- Kladivko, E. 2016. Cover crops for soil nitrogen cycling. <http://www.ag.purdue.edu/agry/extension/Documents/CoverCropsNitrogen.pdf>

Research publications

- Rorick, J.D., and E.J. Kladivko. (2017). Cereal rye cover crop effects on soil carbon and physical properties in southeastern Indiana. J. Soil Water Cons. (accepted)
- Grebliunas, B.G, Perry, W.L. and Armstrong, S.D. 2016. Changes in water extractable organic carbon with cover crop planting under continuous corn production. Air, Soil and Water Research 9:45-54.

Graduate students—1 Ph.D. 7 M.S.

Research

Ongoing studies by Dr. Eileen Kladivko (kladivko@purdue.edu) and graduate students include:

- Effects of cover crops on soil health. This project began in fall 2012 as part of a Conservation Innovation Grant (CIG) project (see Extension listings). Research plots at three Purdue Agricultural Centers were started with oats/radish, cereal rye, and oats/radish/crimson clover/cereal rye mixes in replicated plots under both corn and soybeans. Measurements include a variety of soil health parameters, and selected measurements are also being made on 12 farmer cooperator sites. In 2016 there were six conventional neighbors added to the sites for soil health sampling. In addition, measurements of mycorrhizal fungi, soil aggregation, and active carbon were initiated on some sites. A new Purdue farm plot was begun with a 12-way cocktail mix vs. oats vs. no cover crop control. A post-doc was hired in January 2017 to do data analysis of the many measurements made over the past four years. **See posters by Jennifer Woodyard and Nicole Benally (M.S. students) and Stacy Zuber (post-doc).**
- Corn Systems Coordinated Agricultural Project (CSCAP)—We were part of a large regional project on corn systems and climate, led by Dr. Lois Wright Morton at Iowa State, that just finished in February 2017. The project included 10 states and over 40

principal investigators. Cover crops were one of the practices being studied by about six of those states. The objectives were to determine the effect of cereal rye cover vs. no cover, in both corn and soybeans, on the resilience of the system to climate stresses. This includes measurements of soil moisture content, soil quality measures, soil nitrate in fall and spring, and crop growth and yield. Cereal rye was chosen as the cover crop because it was the most widely adaptable across the whole region in the project. Manuscripts on the combined regional cover crop portion have been drafted and are nearing submission. Joe Rorick.

Ongoing studies led by Dr. Shalamar Armstrong (sarmstro@purdue.edu) and graduate students

- The influence of cover crop inclusion on soil microbiome diversity and functionality. Experimental factors consist of crop rotation, tillage, and above ground cover crop diversity. On both soil and cover crop residue, measurements of enzymatic activity are being used to indirectly quantify the cycling of carbon and nitrogen with time. Furthermore, selected soil samples are being analyzed for microbial diversity to determine the impact of the treatment on the soil microbiome functionality. **See poster by Clayton Nevins (M.S. student).**
- The synchronization of cover crop N release with the N demand of cash crops. At ACRE in West Lafayette, IN and the Nitrogen Management Research Field Station (NMRFS) in Lexington, IL, cover crop residue decomposition and N release are being measured within multiple crop rotations, (Corn-Corn and Soybean-Corn), and tillage systems (No-till and Spring Till). After cover crop termination in the spring, cover crop residue initial weight, C, and N content are quantified and then monitored throughout the cash crop growing season for each treatment combination. In addition to monitoring cover crop residue decomposition, we are establishing research methodology to track the fate of fertilizer N using ¹⁵N stable isotope techniques. This methodology will allow us to quantify the interaction of cover crops with fertilizer N, the release of scavenged N from cover crop residue, and the absorption of cover crop N by a subsequent corn crop. **See poster by Corey Lacey (Ph.D. student).**
- Impacts of nitrogen application timing and cover crops on crop production and water quality. This research is being conducted at the NMRFS that consists of 15 individually monitored tiled-drained 1.6-acre fields in Lexington, IL. The study analyzes three nutrient loss reduction strategy scenarios (1) moving nitrogen application from fall to spring, (2) moving nitrogen application from fall to spring with the addition of cover crops, and (3) fall applying a dominant portion of the annual N rate into a living stand of cover crops. Tile water flow and velocity are monitored automatically to discern the influence of treatments on discharge. Additionally, water samples are collected from the tile water and are analyzed for nitrate and phosphorus to determine the impact of treatments on water quality. **See poster by Michael Ruffatti, (support scientist).**
- The effect of cover crops on surface water quality: A paired watershed experiment in the Lake Bloomington watershed. We are investigating the impact of mass adoption of cover crops on water quality and spring soil nitrogen concentrations. In the Lake Bloomington watershed of Towanda, IL we identified two sub-watersheds, one of 1100 acres and another of 700 acres. Fifty percent of the larger watershed was cover cropped and no

cover crops were applied to the 700-acre watershed. Continuous water samples are collected on a flow-proportional basis at the outlet of each watershed. Water samples are analyzed for nitrate, total phosphorus, and sediments. To determine the impact of cover crops on spring soil inorganic N form and location within the soil profile, spring soil samples are collected and are analyzed for ammonium and nitrate. **See poster by Richard Roth (M.S. student).**

Ongoing studies led by Dr. Shaun Casteel, Dept. of Agronomy (scasteel@purdue.edu)

- We applied swine manure following wheat and evaluated 12 cover crop systems to manage the nitrogen for subsequent corn crop. Five pre-plant N rates were crossed with the 12 cover crop systems. We finished the second cycle of this project with corn harvest in 2015, and sample analysis and data interpretation is ongoing.
- Shalamar and I established long-term conservation cropping systems at two PACs (NEPAC and DPAC) in 2016. The system will include 6 cover crop systems and manure application following wheat in a soybean-wheat-corn rotation. We have also pooled resources to purchase a high clearance sprayer to be modified to interseed cover crops in standing corn and soybeans at a medium plot scale (15 or 30-ft wide plots that are ~300-ft long).

Ongoing studies by Dr. Keith Johnson, Dept. of Agronomy (johnsonk@purdue.edu)

- Utilizing cover crops and summer annuals as double cropped forages following wheat . The objective is to determine the suitability and forage quality of ten crop species at varying nitrogen application rates. The crops that are being investigated are; grain amaranth, BMR sorghum sudangrass, pearl millet, teff, foxtail millet, oat, chickling vetch, forage turnip, and oilseed radish.

Ongoing studies by Dr. Lori Hoagland, Dept. of Horticulture (lhoaglan@purdue.edu)

- The long-term goal of Dr. Hoagland's research program is to identify management practices that will improve nutrient-use efficiency, help plants withstand biotic and abiotic stress, and reduce colonization by human pathogens. To this end, she studies how management practices, including cover crops, affect the composition and activity of soil microbial communities. The majority of her research is currently being conducted in intensively managed vegetable production systems, but she has also worked in grain production systems as well. Recent studies have provided evidence that including cover crops and amending soil with compost can increase the diversity and abundance of arbuscular mycorrhizal fungi, and thereby help plants withstand drought stress. Soils fertilized with leguminous cover crops are better able to withstand infection by soil-borne plant pathogens, and have lower abundance of potential human pathogens than soils fertilized with urea. Finally, growing certain species and varieties of cover crops increase populations of microbial taxa with biocontrol activity and ameliorate disease incidence in soil infested with long-lived soil-borne plant pathogens.

Ongoing studies by Dr. William Johnson addresses the following 7 topics:

- 1) The role of cover crops in the epidemiology of Goss's wilt
- 2) Palmer amaranth control provided by annual ryegrass and cereal rye
- 3) Spring termination of cover crops with herbicides
- 4) The effect of herbicide residues on cover crop establishment.
- 5) New project initiated this past fall - The effect of planting green on corn and soybean yield
- 6) New project initiated this past fall - The effect of a failed cover termination on corn and soybean yield.
- 7) We submitted a proposal to ISMC to evaluate the effect of cover crops on control of herbicide resistant weeds in corn.

Ongoing studies by Dr. Bryan Young, and Dr. Bill Johnson, Dept. of Botany and Plant Pathology (BryanYoung@purdue.edu; WGJ@purdue.edu)

Young--We have two projects with the United Soybean Board that are being conducted collaboratively with the Univ. of WI, Univ. of MO, Univ. of TN, and Univ. of AR.

- 1) Evaluation of herbicides for spring termination of cover crops.
- 2) Evaluation of potential herbicide carryover to fall-seeded cover crops.

Johnson--conducts applied research on weed control provided by cover crops, spring termination of cover crops with herbicides, and the effect of herbicide residues on cover crop establishment.

Christian Krupke, Dept. of Entomology (ckrupke@purdue.edu) —Extension work speaking with producers and consultants about the insect pest management challenges associated with cover crops, and how to scout for and manage them.

Some long-term or always ongoing studies continues:

- Cereal rye or other cover crops used in tile drainage research project, where nitrate is measured in tile drainflow. Long-term (25+yrs) but no simultaneous comparison without cover crop. Could make more measurements related to N cycling, if regional collaboration.
- Biomass crops, new and old work (Miscanthus, switchgrass)
- Ongoing work on pest suppression (disease, nematode, weeds) and in vegetable production (Dept. of Botany and Plant Pathology; Dept. of Horticulture)
- Always ongoing work on forages for hay or grazing (Dr. Keith Johnson, Dept. of Agronomy, johnsonk@purdue.edu)

Extension/Education/Outreach/On-farm trials

Cover crop interest and adoption continues to grow in Indiana. All of the partners in the Indiana Conservation Partnership continue to see the need for increased training and services related to cover crops. The Indiana Conservation Partnership includes NRCS, Soil and Water Conservation Districts (SWCD), Conservation Cropping Systems Initiative (CCSI), Indiana State Department of Agriculture (ISDA), State Soil Board, and Purdue Extension. Highlights of major activities are given here:

1. Conservation Cropping Systems Initiative (CCSI)--A Conservation Innovation Grant (CIG) was awarded to the Indiana Association of Soil and Water Conservation Districts (IASWCD) and partners of Purdue Extension, ISDA, NRCS, and others, starting in fall 2012. Although the grant is now completed, the base of work continues through other funding. The project established four regional hubs around the state, for trainings and workshops on soil health. The major practices being discussed are cover crops and conservation cropping systems, especially no-till. Twelve farmer cooperators are involved in helping train-the-trainers and mentoring other farmers who want to transition to conservation cropping systems. Activities include strip trials of their current system vs. a new practice on their farms, workshops and field days on their farms, and field trials and trainings at regional university research farms. Train-the-trainer workshops have included Advanced Cover Crops and Advanced Conservation Cropping Systems, one of which was offered in each regional hub each year. At least three farmer workshops per regional hub are offered each year and include a variety of topics. Soil health sampling is accomplished by regional teams pulled from across the Partnership, strengthening ties among the participating agencies. **The program has grown and now includes a Director (Lisa Holscher, lisa.holscher@in.nacdn.net), a program coordinator, a communications specialist, and an agronomist (Joe Rorick, jdrorick@purdue.edu). See the presentation by Lisa Holscher and Jamie Scott on Wednesday!**
2. Introduction to Soil Health workshops, as train-the-trainer opportunities. These are aimed at providing an introduction to soils and soil health, cover crops, and no-till, to new employees and to those wanting a refresher on some of the concepts being brought to farmers at soil health field days and workshops. The costs are covered by SARE funds allocated to the state through our SARE representative Roy Ballard
3. Soil Health, in-depth 3-day training. This training is led by Barry Fisher, NRCS National Soil Health Division, with assistance from Kladvko, and others. The main audience is NRCS but other participants include county Extension, SWCD, and ISDA field staff.
4. The second edition of the Cover Crop Pocket Guide continues to be a hot seller! Its Sept 2014 printing run of 20,000 copies sold out in less than a year, and another 10,000 were printed. Those sold out again and in February 2017 another 20,000 copies were printed. The new iphone app work began in fall 2016 after the hiring of the MCCC program manager, and is nearly ready to start obtaining bids for the app development company.
5. Soil Health Partnership (SHP)—This new initiative by National Corn Growers, Monsanto, The Nature Conservancy, and Environmental Defense Fund, has many of the same objectives as the Indiana CCSI, but it has expanded the area to all three “I” states (Iowa, Illinois, Indiana). We continue to have discussions to try to coordinate and collaborate between these two programs. The SHP has a need for various extension materials related to cover crops, that I think MCCC might be able to help with and that fits our mission.
6. Jasper County SWCD Cover Crop Demonstration Program continued in 2016. This continues to be an excellent example of on-farm cover crop demonstrations, with many different farmers participating. Led by Dan Perkins, Watershed and Conservation Program Specialist (www.jaspercountyswcd.org). Other demonstration

plots or on-farm trials occurred at various locations around the state, usually initiated by farmer interest but often facilitated by NRCS, SWCD, Extension, or consultants.

7. Cover crops are now part of the “tillage transect” done in Indiana in the spring after planting. In addition, at least some counties did a fall transect, to document cover crop fields in November.
8. Dr. William Johnson of Purdue University (Weed Science) extended knowledge on the subjects of (1) spring residual herbicide and cover crop interaction, (2) spring cover crop termination, (3) reemergence of cover crops in during corn or soybean growing season and (4) seed contamination issues and rape seed mixtures. He also lead the development of a regional extension publication developed that addresses the ability of cover crops to control weeds, insect and crop disease on a regional scale.
[\(http://cropprotectionnetwork.org/general-crop-management/cpn-4002-cover-crops-dos-donts/\)](http://cropprotectionnetwork.org/general-crop-management/cpn-4002-cover-crops-dos-donts/)