

NCCC211 2016-2017

Meeting date: 9 March 2017, Grand Rapids MI

Reporting dates: March 2016 to March 2017

Participants: Andy Lensen (Iowa State Univ.), DeAnn Presley (Kansas State Univ.), Eileen Kladvko (Purdue Univ.), Shalamar Armstrong (Purdue Univ.), Matt Ruark (Univ. Wisconsin-Madison), Erin Haramoto (Univ. Kentucky), Dean Baas (Michigan State Univ.), Marisol Berti (North Dakota State Univ.).

Agenda

Tuesday, March 14, 2017

7:15 am-8:15am NCCC 211 Project Meeting
8:30am - State and Province Reports: Ohio, South Dakota, Wisconsin, Kansas,
10:15am Nebraska, Illinois
10:30am- State and Province Reports: Michigan, North Dakota, Minnesota, Iowa,
12:15pm Ontario, Missouri.
1:30pm-3:00 pm Working session breakouts
3:00 – 3:15 pm Poster Session
3:15 - 4:15pm Partnership reports
4:30pm-5:30pm Midwest Cover Crops Council Board of Directors Meeting
5:30pm-6:30pm

Wednesday 24 February 2016

8:30 am to 4:45 pm A full list of presentations is online:

<http://mccc.msu.edu/wp-content/uploads/2016/10/Conference-Program-Final.pdf>

Accomplishments

Midwest Cover Crop Field Guide 2nd Edition

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.

NCCC-211 Committee member's accomplishments

Accomplishments by state

Kansas

Extension and research efforts on cover crops are very active in Kansas. The most notable accomplishment is the addition of Kansas to the Midwest Cover Crops Council Cropland Decision Tool. Twenty cover crop experts in Kansas spent more than one year ranking cover crops for the various attributes and compiling necessary data, and the announcement was made in April 2016 that Kansas was now a choice in the list of states. Currently in Kansas there are 14 university researchers with active research projects ranging in topics from erosion control, water quality, N cycling, weed suppression, evaluation in cropping systems, effects on soil moisture, soil health, companion planting with winter wheat, control of charcoal rot in soybean, and forage production and quality. Numerous extension presentations featuring cover crop research were made to approximately 1,500 producers and

agricultural professionals. A recent SARE-funded train-the-trainer project focuses on soil health for vegetable applications and the target audience was extension agents and conservation district staff. Webinars were recorded and serve as study materials for the participants prior to coming to a one-day workshop. See www.soilhealthbootcamp.com for more information.

Kentucky

Cover crops acreage in 2016 is estimated at approximately 120,000 acres, or about 3% of the total row crop acreage in Kentucky. The USDA-NRCS EQIP cost-shared approximately 10,000 acres, while the NRCS CStP Enhancement cost-shared an additional 365 acres in continuous cover cropping. Extension and research personnel at the University of Kentucky held approximately 240 meetings and 50 field days, reaching over 11,700 individuals. Of these, approximately 25% focused on the use of cover crops as forages and in pastures. In 2016, UK and Kentucky State University supported eight graduate students conducting research on cover crops, with support from 27 different grants funded by national, regional, and state institutions, as well as commodity boards.

Indiana

Anna Morrow was hired July 1, 2016, as the Midwest Cover Crops Council Program Manager and is employed by Purdue University. 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. Numerous research projects are ongoing with objectives such as the effects of cover crops on soil health, resilience of cropping systems to climate stress, cover crop influence on soil microbiome diversity, syncing N release of cover crops with the N demand of cash crops, surface water quality, forage quality, weed science, and pest suppression.

Iowa

Cover crops were planted in Iowa on an estimated at 591,880 acres in fall of the 2015-2016 winter, nearly 2.5% of the annual row-crop acreage produced in the Iowa in 2015. The Iowa Department of Agriculture and Land Stewardship cost-shared 177,000 acres, USDA-NRCS EQIP contracted 92,000 acres, and USDA-NRCS CSP had an additional 217,000 acres contracted that included cover crop enhancements. Outreach efforts on cover crop in Iowa reached over 10,000 individuals through 188 activities, including on-farm meetings, Iowa State University Extension articles, and Practical Farmers of Iowa outreach activities. Other cover crop outputs included publication of six refereed scientific articles and two MS theses. For 2016, there were eight graduate students, two post-doctoral associates, and one research associate conducting research on cover crops with support from six funded grant proposals.

Michigan

Michigan State University (MSU) continues its commitment to cover crop research, publications and outreach in 2016. Activities included 25 on-going research projects, 7 scientific/society presentations, 9 peer-reviewed publications, 19 Extension/outreach publications and 37 Extension presentations. Research projects include evaluation of cover crops for: 1) pest/disease management for weeds, diseases and/or nematodes across field crops, vegetables and/or forages; 2) herbicide carryover on cover crop use; 3) cover crops for herbicide resistant weeds; 4) management across commodities including field crops, vegetables, fruit and tree nuts and ornamentals; and 5) soil health. The relaunched MSU Michigan cover crop website (www.covercrops.msu.edu) had 5,401 visits and 7,352 page views

from March 2016 – December 2016. Twenty-one events that included cover crops were held in Michigan in 2016 reaching over 2300 participants. In 2016 there were 19 cover crop Extension articles published on the MSU Extension News page (http://msue.anr.msu.edu/topic/info/cover_crops). MSU cover crop researchers and educators were involved in three of the nine topic sessions at the inaugural MSU Ag Innovations Day – Focus on Soils reaching over 400 farmers. MSU also educated hundreds of undergraduate and graduate students through 13 different courses in the Departments of Plant, Soil, and Microbial Science, Entomology, and Horticulture that include cover crops in their curriculum. There were five M.S. and one Ph.D. students with cover crop related research projects.

Minnesota

During 2016 there were at least 11 shareholder groups in the MN that were directly involved in cover crop research, education, outreach, and demonstration. There were 87 cover crop events in 2016, with 48% lead by the University of Minnesota, 24% lead by NRCS, and 4% lead by United States Department of Agriculture -Agricultural Research Services (USDA-ARS). Non-stated and federal agencies hosted 12% of the cover crop events in 2016. Total attendance was 4500 where 56% attended University of Minnesota educational events. In addition to hosting cover crop events across the state, there were eight papers presented at American Society of Agronomy Meetings, one peer reviewed paper, one soil health educational manual for immigrant farmers, and three extension newsletters. There were five media events throughout the year with one each from University of Minnesota, USDA-ARS, Sustainable Farmers of America, and two from NRCS. There were 22 new projects funded in 2016, directly associated with cover crop research, education, and outreach. Funding was divided between three sources; 18% from state commodities boards, 35% from state legislature, and 47% from federal funding pools with total funding for 2016 at \$3.97 million.

North Dakota

Cover crops awareness and adoption in North Dakota is growing very fast. The cropping systems CAP project funded by NIFA-USDA and the PDP funded by SARE have provided valuable resources to advance research in cover crops and bring the information directly to farmers. Research in North Dakota includes interseeding into standing soybean and corn, winter rye as a forage for hay, silage and grazing, interseeding of clovers into wheat, nutrient cycling, soil health and many more.

We reached over 500 farmers in 21 field days and tours, 13 Café Talks and 2 workshops. We have 20 farmers collaborating directly with research projects and conducting on-farm research.

Wisconsin

Educated over 2,000 farmers, crop consultants, and governmental agency workers on cover crops. Hosted the 2016 MCCC Meeting: The Science of Cover Crops (120 attendees), as well as the NCCC 211 committee meeting, in Madison, WI.

Impacts:

1. Outreach efforts reached more than 25,000 contacts through combinations of in-person meetings and workshops, websites, written media, webinars, etc.
2. Increased numbers of enrolled and/or graduated students from graduate programs focusing on cover crop research and management.

3. Soil erosion by wind is a serious problem especially during winters with little snowfall or dry springs. Cover crops are reducing erosion and increasing sustainability of cropping systems.
4. Cover crops have been included as a nutrient loss reduction practice for both N and P in the Nutrient Reduction Strategies for Iowa, Minnesota, Ohio, and Illinois which should result in improved water quality.
5. Cover crops will impact Midwest's economy by improving soil health, nutrient cycling, productivity of grain and energy crops, reducing expensive nitrogen inputs, and increasing supply of supplemental summer and fall forage.
6. Adoption of cover crops in the Upper Mississippi Basin and Great Lakes Region continues to increase through 2016.

Publications

Peer-reviewed

- 1 Acharya, J., M.G. Bakker, T.B. Moorman, T.C. Kaspar, A.W. Lenssen, and A.E. Robertson. 2017. Time interval between cover crop termination and planting influences corn seedling disease, plant growth, and yield. *Plant Disease*: in press. <http://dx.doi.org/10.1094/PDIS-07-16-0975-RE>
- 2 Basche, A.D., Archontoulis, S., Kaspar, T.C., Jaynes, D.B., Parkin, T.B., Miguez, F. 2016. Simulating long-term impacts of cover crops and climate change on crop production and environmental outcomes in the midwestern United States. *Agriculture, Ecosystems and Environment*. 218:95-106. doi: 10.1016/j.agee.2015.11.011.
- 3 Basche, A.D., Kaspar, T.C., Archontoulis, S., Jaynes, D.B., Sauer, T.J., Parkin, T.B., Miguez, F. 2016. Soil water improvements with the long-term use of a winter rye cover crop. *Agricultural Water Management*. 172:40-50. doi: 10.1016/j.agwat.2016.04.006.
- 4 Berti, M.T., R.W. Gesch, C. Eynck, J. Anderson, and S. Cermak. 2016. Camelina uses, genetics, genomics, production and management. *Ind. Crops Prod.* 94:690-710.
- 5 Berti, M.T., B.L. Johnson, R.W. Gesch, and A. Aponte, 2016. Environmental impact assessment of double- and relay-cropping with winter camelina in the northern Great Plains, USA. *Agricultural Systems* (submitted, under review)
- 6 Berti, M.T., D. Samarappuli, B.L., Johnson, and R.W., Gesch. 2017. Integrating winter camelina into maize and soybean cropping systems. *Ind. Crops Prod.* (Submitted, under review).
- 7 Brainard, D.C., A. Bryant, D.C. Noyes, E.R. Haramoto and Z. Szendrei. 2016. Evaluating pest-regulating services under conservation agriculture: A case study in snap beans. *Agriculture, Ecosystems and the Environment* 235: 142-154.
- 8 Cates, A.M., M.D. Ruark, J.L. Hedtcke, and J.L. Posner. 2016. Long-term tillage, rotation and perennialization effects on particulate and aggregate soil organic matter. *Soil Till. Res.* 155:371-380.
- 9 Grabau, Z.J., Z.T. Maung, D.C. Noyes, D.G. Baas, B.P. Werling, D.C. Brainard, H. and Melakeberhan. 2016. Effects of oat, oilseed radish, and oilseed rape cover crops on *Pratylenchus penetrans* and the nematode community in Michigan carrot production, *J Nematol.* In press.
- 10 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.
- 11 Haramoto, E.R., and D.C. Brainard. 2017. Spatial and temporal variability in Powell amaranth (*Amaranthus powellii*) emergence under strip tillage with cover crop residue. *Weed Science* 65: 151-163.

- 12 Hill, E.C., K.A. Renner, C.L. Sprague, and A.S. Davis. 2016. Cover crop impact on weed dynamics in an organic dry bean system. *Weed Sci.* 64:261-275.
- 13 Hill, E. C., K.A. Renner, and C.L. Sprague. 2016. Cover crop impact on nitrogen availability and dry bean characteristics in an organic system. *Agron. J.* 108:329-341.
- 14 Krasnow, C.S. and M.K. Hausbeck. 2015. Pathogenicity of *Phytophthora capsici* to Brassica vegetable crops and biofumigation cover crops (*Brassica* spp.). *Plant Disease.* 99:1721-1726.
- 15 Lowry, C. and D.C. Brainard. 2016. Strip-intercropping of rye-vetch mixtures affects biomass, C:N ratio, and spatial distribution of cover crop residue. *Agron J* 108: 2433-2443.
- 16 Martinez-Feria, R.A., R. Dietzel, M. Liebman, M.J. Helmers, S.V. Archontoulis. 2016. Rye cover crop effects on maize: a system-level analysis. *Field Crops Research* 196:145-159. doi.org/10.1016/j.fcr2016.06.016.
- 17 Martinez-Feria, R., Kaspar, T.C., Wiedenhoef, M.H. 2016. Seeding date affects fall growth of winter canola (*Brassica napus* L. 'Baldur') and its performance as a winter cover crop in central Iowa. *Crop, Forage & Turfgrass Management.* 2(1). doi: 10.2134/cftm2015.0181.
- 18 McDaniel, M.D, A.S. Grandy, L.K. Tiemann, and M. N. Weintraub. 2016. Eleven years of crop diversification alters decomposition dynamics of litter mixtures incubated with soil. *Ecosphere* 7(8) Article e01426.
- 19 Pantoja, J.L., K.P. Woli, J.E. Sawyer, and D.W. Barker. 2016. Winter rye cover crop biomass production, degradation, and nitrogen recycling. *Agron. J.* 108:841-853. doi:10.2134/agronj2015.0336.
- 20 Quinn, N.F., D.C. Brainard, and Z. Szendrei. 2016. The effect of conservation tillage and cover crop residue on beneficial arthropods and weed seed predation in acorn squash. *Environ Entomol.* 45:1543-1551.
- 21 Quinn, N.F., D.C. Brainard, and Z. Szendrei. 2016. Floral strips attract beneficial insects but do not enhance yield in cucumber fields. *J Econ Entomol.* In press
- 22 Rorick, J.D., and E.J. Kladvko. (2017). Cereal rye cover crop effects on soil carbon and physical properties in southeastern Indiana. *J. Soil Water Cons.* (accepted)
- 23 Tumbalam, P., K. Hard, and K. Thelen. 2016. Integrating winter annual cereal rye or triticale into a corn forage biofuel production system, *J Crop Improv.* 30:526-530. DOI: 10.1080/15427528.2016.1189472.
- 24 West, J.R., M.D. Ruark, A.J. Bussan, J.B. Colquhoun, and E.M. Silva. 2016. Nitrogen and weed management for organic sweet corn production on loamy sand. *Agron. J.* 108:1-12.

Book chapters

- 1 Wick, A.F., M. Berti, Y. Lawley, M. Liebig. 2016. Chapter 6: Integration of Annual and Perennial Cover Crops for Improving Soil Health. *Soil Health and Intensification of Agroecosystem* (Ed.M. Al-Kaisi, B. Lowery)

Proceedings

- 1 Berti, M.T., A. Aponte, B.L. Johnson, and D. Ripplinger. 2016. Environmental sustainability of double- and relay-cropping of food, feed, and fuel crops in the northern Great Plains, USA. In 24th European Biomass Conf. and Exhibition. 5-9 June, 2016, Amsterdam, The Netherlands Available at <http://www.etaflorence.it/proceedings/index.asp> (verified 10 December 2016).

Conferences and abstracts

- 1 Acharya, J., Bakker, M.G., Kaspar, T.C., Moorman, T.B., Lenssen, A., Robertson, A. 2016. Effect of date of termination of a winter cereal rye cover crop (*Secale cereale*) on corn seedling disease. American Phytopathological Society Annual Meeting. 106:S1.1.
- 2 Appelgate, S., A. Lenssen. 2016. Cover crop options and mixes for the Upper Midwest: Is a winter rye monoculture the only option? ISRF15-16,30.
http://farms.ag.iastate.edu/sites/default/files/CoverCropOptions_0.pdf
- 3 Archontoulis, S. 2016. Understanding rye cover crop effects on corn.
<http://crops.extension.iastate.edu/blog/sotirios-archontoulis/understanding-rye-cover-crop-effects-corn>
- 4 Bakker, M.G., Moorman, T.B., Kaspar, T.C., Manter, D.K. 2016. Winter rye cover crops as a host for corn seedling pathogens. American Phytopathological Society. 106:S1.2. doi: 10.1094/PHYTO-106-1-s1.1
- 5 Banik, C., C. Bartel, D.A. Laird, K.J. Moore, and A.W. Lenssen. 2016. Impact of a corn-living mulch cropping system on soil C- and N-dynamics. ASA Phoenix AZ
- 6 Bartel, C.A., A.W. Lenssen, K.J. Moore, D.A. Laird, S.V. Archontoulis. 2016. Perennial cover establishment in row crop systems for sustainable biofuels productions. University of Minnesota Production Agriculture Symposium, DuPont Plant Sciences Symposia Series. Minneapolis, MN.
- 7 Bartel, C.A., A.W. Lenssen, K.J. Moore, D.A. Laird, and S.V. Archontoulis. 2016. Living mulch establishment in row crop systems for sustainable biofuels production. ASA Phoenix AZ
- 8 Bartel, C.A., A.W. Lenssen, K.J. Moore, D.A. Laird, S.V. Archontoulis. 2016. Perennial cover crop establishment for sustainable corn stover biomass production. The Inaugural Soil Health Conference, Ames, IA.
- 9 Berti, M.T., B.L. Johnson, R.W. Gesch, J. Ransom, H.H. Kandel, M. Kazula, M.S. Wells, and A. Lenssen. 2016 Integrating camelina into corn and soybean cropping systems. p. 9 *In* Berti, M.T. and E. Alexopoulou (Eds.) 28th Annual Meeting of the Association for the Advancement of Industrial Crops (AAIC), Rochester, NY, 14-19 September, 2016.
- 10 Berti, M.T., J. Lukaschewsky, and M. Kazula. 2016. Alfalfa silage corn interseeding in North Dakota. North American Alfalfa Improvement Conference, Trifolium Conference and Grass Breeders Conference. Madison, WI. 12-14 July, 2016.
- 11 Berti, M.T. Interseeding cover crops into standing corn and soybean: what, when and how. Agriculture Production Symposium, University of Minnesota, 22-23 February 2017.
- 12 Bjorkman, T, D.C. Brainard, C. Lowry and J. Masiunas. 2016. Fall incorporation of cover crops reduces snap bean stand. Poster no. 339. American Society for Horticultural Science Annual Meeting. August 2016, Atlanta, GA. (poster)
- 13 Brainard, D.C., N. Quinn, E. Haramoto, M. Frost and Z. Szendrei. 2016. Tillage and cover crop effects on seed predation and decay in a long-term vegetable rotation. Abstract no. 362. Weed Science Society of America Annual Meeting. February 2016. San Juan, Puerto Rico.
- 14 Brooker, A., K. Renner, and C. Sprague. 2016. Critical cover crop-free period in corn. North Central Weed Science Society Annual Meeting. Dec. 12-15, 2016. Des Moines, IA.
- 15 Brooker, A., K. Renner, C. Sprague, and L. Tiemann. 2016. Interseeding cover crops in Michigan corn rotations. ASA-CSSA-SSSA International Meeting. Nov. 6-9, 2016. Phoenix, AZ.
- 16 Delate, K., R. Johnson. 2016. Comparison of organic and conventional crops at the Neely-Kinyon long-term agroecological research site. ISRF15-12.
<http://farms.ag.iastate.edu/sites/default/files/ComparisonOrganicArm.pdf>

- 17 Davis, Cahtyn, D.R. Presley, J. Farney, G.F. Sassenrath. 2016. Cost-benefit analysis of multi-species cover crop mixtures used for supplemental forage. ASA-CSSA-SSSA International Meeting. Nov. 6-9, 2016. Phoenix, AZ.
- 18 Davis, Cathryn, D.R. Presley, G.F. Sassenrath, J. Farney. Multi-species cover crop mixtures; Forage Quantity and Quality for Fall Grazing. ASA-CSSA-SSSA International Meeting. Nov. 6-9, 2016. Phoenix, AZ.
- 19 Dose, H.L., R. Gesch, F. Forcella, B.L. Johnson, K. Aasand, M.S. Wells, A. Lenssen, S. Patel, M.T. Berti. 2017. Determining optimum time to seed winter cover crops into standing corn and soybean in the northern Corn Belt. Production Agriculture Symposium, University of Minnesota, St. Paul, MN, 22-23 February, 2017.
- 20 Fawcett, J. J. Sievers, L. Rossiter. 2016. On-Farm cover crop trials. ISRF15-29,31. http://farms.ag.iastate.edu/sites/default/files/CoverCrops_2.pdf
- 21 Gibbs, L., M.S. Coyne, and J. Grove. Potential Nitrogen Benefits from Cover Crops. Kentucky No-Till and Cover Crop Soil Health Forum. Princeton, KY, March 2017.
- 22 Haramoto, E.R. and M.T. Allen. Influences of cover crop seeding rate and species selection on winter annual weeds prior to soybean. 57th Annual Meeting, Weed Science Society of America. Tucson, Arizona, February 2017. Abstract 286.
- 23 Haramoto, E.R. Winter cover crop species, seeding rate affects winter annual weeds. 71st Annual Meeting, North Central Weed Science Society. Des Moines, IA. December 2016. Abstract 222.
- 24 Hayden, Z.D., C. Lowry, D.C. Noyes and D.C. Brainard. 2016. System effects of strip tillage and compost with zonal cover cropping in organic broccoli. Abstract. American Society for Horticultural Science Annual Meeting. August 2016, Atlanta, GA.
- 25 Jacobsen, K. Healthy Soils Under Cover. Organic Association of Kentucky Annual Conference. Shephardsville, KY. March 2017.
- 26 Jacobsen, K. Integrated Nutrient Management in Organic Farming Systems. Organic Association of Kentucky Annual Conference. Shephardsville, KY. March 2016.
- 27 Martin, R.M., J.E. Rowntree, K.A. Cassida, and D. Carmichael. 2016. Impact of high-energy forages on grass-finished steer performance and carcass merit. J. Anim. Sci (E-Suppl. 5)/J. Dairy Sci. (E-Suppl. 5):311. Joint Annual Meeting, Salt Lake City, Utah, July 19-23, 2016. (poster)
- 28 Pantoja, J.L., J.E. Sawyer, K.P. Woli, and D.W. Barker. 2016. Use of winter rye (*Secale cereale* L.) cover crop for nitrogen recycling in a corn-based cropping system. In proc. 21st Century Watershed Technology Conference and Workshop, Quito Ecuador, 3-9 Dec. 2016. ASABE, St. Joseph, MI.
- 29 Patel, S., J.E. Sawyer, and J.P. Lundvall. 2016. Root and shoot biomass and nutrient composition in a winter rye cover crop. In Annual Meetings Abstract (on-line), ASA, Madison, WI.
- 30 Shockley, J.M. An integrated extension approach to poultry litter best management practices in Kentucky. Southern Extension Economics Committee Meeting. Pointe Clear, AL. July 2016
- 31 Shockley, J.M. Determining the economic value of poultry litter. Kentuckiana. French Lick, IN. November 2016
- 32 Shockley, J.M. Determining the economics of poultry litter. Mid-Atlantic Management School. Ocean City, MD. November 2016
- 33 Tiemann, L.K. 2016. Belowground benefits of rotational diversity. National No-tillage Conference, Indianapolis, IN- featured presentation

Extension Publications

- 1 Kladvko, 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>
- 2 Kladvko, E. 2016. Cover crops for soil nitrogen cycling. <http://www.ag.purdue.edu/agry/extension/Documents/CoverCropsNitrogen.pdf>
- 3 Krzton-Presson, J., A. Nair. 2016. Effects of tillage and cover crops on muskmelon production and food safety. ISRF15-36. http://farms.ag.iastate.edu/sites/default/files/EffectsTillage_0.pdf
- 4 Licht, M., L. Juchems, J. Comito, M. Helmers, S. Carlson. 2016. Demonstrating cover crop mixtures on Iowa farmland: Management, soil health, and water quality benefits. ISRF15-35. http://farms.ag.iastate.edu/sites/default/files/DemonstratingCoverCroMcN_0.pdf
- 5 Patel, S., J. Lundvall, J. Sawyer. 2016. Enhancing corn yield in a winter cereal rye cover cropping system. ISRF15-29,31. http://farms.ag.iastate.edu/sites/default/files/EnhancingCornYield_1.pdf
- 6 Olson, G.L. and S.R. Smith. 2016 Long term Summary of Kentucky Forage Variety Trials. PR-720. University of Kentucky College of Agriculture Food and Environment.
- 7 Pearce, B., A. Bailey (eds). 2017-2018 Burley and Dark Tobacco Production Guide. ID-160. University of Kentucky College of Agriculture Food and Environment.
- 8 Pederson, C., M. Helmers, M. Soupir, A. Mallarino. 2016. Impact of liquid swine manure application and cover crops on nitrate in subsurface drainage water. ISRF15-13. <http://farms.ag.iastate.edu/sites/default/files/ImpactLiquidManure.pdf>
- 9 Shockley, J., E. Ritchey, J. McGrath. Economic Value of Poultry Litter Tool: Grain Crops. AEC 2016-13 University of Kentucky College of Agriculture Food and Environment.
- 10 Snapp, S., L.K. Tiemann, N. Rosenzweig, D. Brainard, G. Bird. (2016) Managing Soil Health for Root and Tuber Crops. MSU Extension Bulletin E-3343, East Lansing, MI.

Extension videos and webinars

- 1 A.F. Wick, M. Berti and C. Langseth. 2016. Cover Crop Selection: Grasses, Extension Education Video, InHouse Productions, <https://www.youtube.com/watch?v=AcIaH-R2U-4>
- 2 A.F. Wick, M. Berti and C. Langseth. 2016. Cover Crop Selection 2: Legumes, Extension Education Video, InHouse Productions, <https://www.youtube.com/watch?v=uzwFPCR8kUQ>
- 3 A.F. Wick, M. Berti and C. Langseth. 2016. Cover Crop Selection 3: Cover Crops after a Cereal Crop, Extension Education Video, InHouse Productions, <https://www.youtube.com/watch?v=YTBw8dF4sdo>
- 4 A.F. Wick, T. DeSutter and C. Langseth. 2016. Cover Crop Selection 4: Soil Temp and Soil Respiration, Extension Education Video, InHouse Productions, <https://www.youtube.com/watch?v=ehEMPf0CWHO>
- 5 Grossman, J. and K. Jacobsen. (October 11, 2016). Soil Health in High Tunnel Production. Natural Resource Conservation Service Soil Health Webinar Series. <http://www.conservationwebinars.net/webinars/soil-health-in-high-tunnel-production>.
- 6 Presley, D.R., M. Kennelly, C. Rivard, R. Cloyd. Soil Health Bootcamp and Applications for Vegetable Production: www.soilhealthbootcamp.com
- 7 Wisconsin Public Television:
<http://wpt.org/University-Place/cover-crops-forages-and-grazing>
<http://wpt.org/University-Place/cover-crops-and-water-quality>
<http://wpt.org/University-Place/cover-crops-nutrient-source>
<http://wpt.org/University-Place/science-soil-health>

<http://wpt.org/University-Place/reducing-soil-erosion-and-improving-soil-health>
<http://wpt.org/University-Place/meta-economics-cover-crops>

Research grants

- 1 Baas, D.G. Michigan Wheat Program. 2016. Evaluation of oilseed radish added to wheat to increase wheat yields in Michigan. \$7,500
- 2 Baas, D.G. Michigan Soybean Promotion Committee & Corn Marketing Program of Michigan. 2016. Using cover crops with wheat to improve rotational profitability. \$28,800
- 3 Berti, M., B. Johnson, D. Ripplinger, H. Kandel, A. Wick, A. Akyuz, J. Ransom, D. Franzen, R. Gesch, F. Forcella, A. Lenssen, S. Wells. 2015-2019, USDA AFRI Food Security CAP, Agricultural Production Systems – Cropping Systems. A5160. A novel management approach to increase productivity, resilience, and long-term sustainability in cropping systems in the northern Great Plains. \$3,739,199.
- 4 Berti, M., Seames, E, Yun J., Morris, G. SUNGRANT, 10/2016-09/2018. \$187,496. Improving cold tolerance in sorghum: a promising feedstock for biofuels and biobased products in the northern Great Plains.
- 5 Bird, G., N. Rosenzweig, L. Tiemann, B. Basso, R. Black, C. Long, M. Otto, C. Carr, B. Morgan, and R. Rant. Michigan Potato Industry Commission. 2016-2017. On-farm soil health research: With special reference to bio-based systems. \$10,625
- 6 Bird, G., N. Rothwell, D. Baas, B. Klein, and K. Powers. 2014-2016. Michigan Cherry Council supported. Impact of cover-crops/mulch/compost on tart cherry orchard development/productivity and soil health. \$3,500
- 7 Brainard, D.C., H. Melakeberhan, Z. Hayden, D. Baas and B. Werling. 2015-2016. MDARD-MI Carrot Council. Optimizing cover crops for weed, nematode and nitrogen management in processing carrots. \$81,677
- 8 Cassida, K.A., J. Islieb, P. Kaatz, and J. Lindquist. 2015. Project GREEN . Yield and nutritive value of annual legumes in Michigan forage systems.
- 9 Coyne, M. and J. Grove. 2015-2017. USDA Natural Resource Conservation Service, Kentucky Office, State Conservation Innovation Grant program. Study the effect of cover crops on soil health and N fertilizer response. \$75,000
- 10 Gleason, M., M. Williams, R. Bessin, J. Harwood. 2015-2018. USDA-OTP. Reinventing sustainable protection systems for cucurbit production. \$499,974.
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- 24 Nair, A., K. Delate, C. Bregendahl, G. Artz. 2014-2016. Leopold Center for Sustainable Agriculture. Quantifying nitrogen credits and impacts of cover crops on soil biology and health in vegetable cropping systems in Iowa. <http://www.leopold.iastate.edu/grants/e2014-16>
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- 26 Pearce, B. and E. Haramoto. 2016-2017. Altria Corp. Cover crop management for no-till production of burley tobacco. \$9,500
- 27 Proctor, C., M. Drewnoski, R. Elmore, S. Everhart, A. McMechan, J. Parsons, D. Redfearn, R. Werle, L. Lindsey, E. Haramoto, M. Salmeron. 2017-2019. USDA AFRI Foundational Knowledge of Agricultural Production Systems Priority area. Optimizing cropping systems for resilience to stress: role of maturity group selection and cover crops on yield, weeds, insects, and microbes. \$460,000
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- 33 Ritchey, E., J. McGrath, B. Lee, E. Haramoto, M. Coyne, J. Shockley. 2017-2018. USDA Natural Resource Conservation Service, Kentucky Office, State Conservation Innovation Grant program Providing a better understanding of cover crop – soil interactions. \$75,000

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- 35 Ruark, M. et al. Fall cover crops following corn silage and manure application. Wisconsin Fertilizer Research Council, 2015-2018.
- 36 Ruark, M. et al. Nitrogen supply from red clover. Wisconsin Fertilizer Research Council, 2016-2018.
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- 39 Tiemann, L. 2016. Foundation for Food & Agricultural Research. Building soil health through rotational diversity and soil microorganisms. \$299,962.

Graduate students in cover crops research

MS students: 8 in Iowa, 5 in Michigan, 7 in North Dakota, 8 in Kentucky, 4 in Kansas, 3 in Wisconsin, 7 in Indiana, 1 in Minnesota

PhD students: 2 in Iowa, 1 in Michigan, 3 in North Dakota, 1 in Kentucky, 0 in Kansas, 0 in Wisconsin, 1 in Indiana, 3 in Minnesota.

Postdoctoral researchers: 2 in Iowa