

Midwest Cover Crop Council Annual Meeting

Minnesota State Report for on 2020 cover crop activities

Contact Information

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Minnesota Highlights:

Extension publications

1. Black, K.L., M.S. Wells, K. Cavender-Bares, G.A. Johnson. 2020. Farming for the Future: Using Rowbots to Interseed Cover Crops. Minnesota Crop News.
2. Bugeja, Shane. 2020. Purple Tansy: Pollinator power player & Cover crop. University of Minnesota Extension Yard and Garden News.
3. Candelaria, N., Grossman, J., Pfeiffer, A., Fernandez, A., & Rogers, M. (2020). Summer cover crop options for organic vegetable farms in the Upper Midwest. eOrganic. <http://eorganic.org/node/34375>
4. Cates, A. M. (2020). *Fridays on the Farm: Virtual tours on soil health*. UMN Crop News Blog. <https://blog-crop-news.extension.umn.edu/2020/05/5-things-to-know-about-haney-soil.html>
5. Cates, A. M., Stahl, L., Peters, T., & DeJong-Hughes, J. (2020). *Cover crop options for pre-pile sugarbeet*. UMN Crop News Blog.
6. Cates, A. M.*, Stahl, L. A.*, & Behnken, L. (2020). *Spring management of prevent plant acres*. <https://blog-crop-news.extension.umn.edu/2019/06/cover-crop-options-for-prevent-plant.html>
7. Cates, A. M. (2020). *New land lease? how to incorporate conservation practices*. UMN Crop News Blog. <https://blog-crop-news.extension.umn.edu/2020/01/new-land-lease-how-to-incorporate.html>
8. Cates, A, L Stahl, and A Garcia y Garcia. 2020. MN Cover Crop “Recipes” now available. <https://blog-crop-news.extension.umn.edu/2019/10/mn-cover-crops-recipes-now-available.html>
9. Cates, A, L Stahl, and A Garcia y Garcia. 2020. Cover crop tool updated. <https://blog-crop-news.extension.umn.edu/2020/10/cover-crop-tool-updated.html>
10. Mulla, David, Brian Gelder, Leif Olmanson, Brent Dalzell, Dan Wheeler, Joel Nelson, and Jake Galzki. 2020. Assessing Soil Residue Cover, Cover Crops and Erosion using Remote Sensing and Modeling: A final report to the Minnesota Board of Water and Soil Resources. http://www.bwsr.state.mn.us/sites/default/files/2020-11/BWSR_Final_report_Sept2020_Residue_Cover_and_Erosion_Final.pdf
11. Rusch, H, JA Coulter, J Grossman, G Johnson, P Porter, and A Garcia y Garcia. 2019. Cover crop strategies to improve nitrogen cycling in corn. <https://blog-crop-news.extension.umn.edu/2019/08/cover-crop-strategies-to-improve.html>

12. Rusch, H, JA Coulter, J Grossman, G Johnson, P Porter, and A Garcia y Garcia. 2019. Interseeding cover crops in corn.
<https://blog-crop-news.extension.umn.edu/2019/06/interseeding-cover-crops-in-corn.html>
13. Stahl, L & Garcia y Garcia, A. 2020. Planting date matters for cover crops too.
<https://blog-crop-news.extension.umn.edu/2020/09/planting-date-matters-for-cover-crops.html>
14. Stahl, L & Garcia y Garcia, A. 2020. Performance of summer-seeded cover crops.
<https://blog-crop-news.extension.umn.edu/2020/07/performance-of-summer-seeded-cover-crops.html>
15. Wayment, J., F.G. Fernández, V. Sharma, and J.M. Baker. 2020. Can kura clover and winter rye covers mitigate nitrate leaching in irrigated sands? In: Proc. of the 50th Annual North Central Extension-Industry Soil Fertility Conference. Online Conference. 18-19 November 2020.
<https://northcentralfertility.com>.
16. Wilson, ML. "Research evaluates soil health benefits of combining manure and cover crops" – MN Corn Blog. June 9, 2020

Research publications

1. Ginakes, P., Grossman, J., Baker, J., & Sooka-sanguan, T. (2020). Living mulch management spatially localizes nutrient cycling in organic corn production. *MDPI Agriculture*, 10(6), 243.
2. Ginakes, P., Grossman, J., Baker, J., & Sooksa-nguan, T. (2020). Tillage intensity influences nitrogen cycling in organic kura clover living mulch. *Nutrient Cycling in Agroecosystems*, 116(1), 71-82.
3. Liu, R, MS Wells, and A Garcia y Garcia. 2019. Cover crop potential of winter oilseed crops in the Northern U.S. Corn Belt. *Arch. Agron. Soil Sci.*, 65(13): 1845-1859.
doi: 10.1080/03650340.2019.1578960
4. Moore, S.A., Wells, M.S., Gesch, R.W., Becker, R.L., Rosen, C.J., & Wilson, M.L. (2020). Pennycress as a Cash Cover-Crop: Improving the Sustainability of Sweet Corn Production Systems. *Agronomy*, 10(5), 614. <https://doi.org/10.3390/agronomy10050614>
5. Yesuf Assen Mohammed, Swetabh Patel, Heather L. Matthees, Andrew W. Lenssen, Burton L. Johnson, M. Scott Wells, Frank Forcella, Marisol T. Berti and Russ W. Gesch. 2020. Soil nitrogen in response to interseeded cover crops in maize–soybean production systems. *Agronomy* 2020, 10(9), 1439; <https://doi.org/10.3390/agronomy10091439>
6. Yesuf Assen Mohammed, Heather L. Matthees, Russ W. Gesch, Swetabh Patel, Frank Forcella, Kyle Aasand, Nicholas Steffl, Burton L. Johnson, M. Scott Wells and Andrew W. Lenssen. 2020. Establishing winter annual cover crops by interseeding into Maize and Soybean. *Agronomy Journal*. <https://doi.org/10.1002/agj2.20062>
7. Perrone, S., Grossman, J., Liebman, A., Sooksa-ngua, T., & Gutknecht, J. (2020). Nitrogen fixation and productivity of winter annual legume cover crops in Upper Midwest organic cropping systems. *Nutrient Cycling in Agroecosystems*, 117, 61–76.
8. Rusch, HL, JA Coulter, JM Grossman, GA Johnson, PM Porter, and A Garcia y Garcia. 2020. Towards sustainable maize production in the U.S. upper Midwest with interseeded cover crops. *PLOS ONE* 15(4): e0231032. doi: 10.1371/journal.pone.0231032

9. West, J. R., Cates, A. M., Ruark, M. D., Deiss, L., Whitman, T., & Rui, Y. (2020). Winter rye does not increase microbial necromass contributions to soil organic carbon in continuous corn silage in North Central US. *SOIL BIOLOGY & BIOCHEMISTRY*, 148. [doi: 10.1016/j.soilbio.2020.107899](https://doi.org/10.1016/j.soilbio.2020.107899)

Graduate students and post-docs

1. Jessica Wayment (M.S.)
2. Ethan Ley (M.S.)
3. Katie Black (M.S.)
4. Hannah Rusch (MS)
5. Rabin KC, (MS)
6. Naomy P. Candelaria Morales (M.S.)

7. Eduardo Lagos (Ph.D.)
8. Sharon Perrone (Ph.D.)
9. Manuel Sabbagh (Ph.D.)

10. Yesuf Assen Mohammed (post-doc)
11. Steve Mulkey (post-doc)

Conference Abstracts

1. Candelaria, N., Grossman, J., Pfeiffer, A., Fernandez, A., & Rogers, M. (2020). Trade-offs between nitrogen delivery and pollinator services using cover crops. Oral Presentation at Woman in Sustainable Agriculture Conference, October 18, 2019.
2. Candelaria, N., Grossman, J., Pfeiffer, A., Fernandez, A., & Rogers, M. (2020). Summer cover crop options for organic vegetable farms in the Upper Midwest. Poster Presentation at MOSES Organic Farming Conference, February 27, 2020.
3. Candelaria, N., Grossman, J., Pfeiffer, A., Fernandez, A., & Rogers, M. (2020). Summer cover crop options for organic vegetable farms in the Upper Midwest. Oral Presentation at ASA-CSSA-SSSA Annual Meeting, November 10, 2020, Virtual.
4. Cates, A. M., Grim, L. 2020 ASA, CSSA, SSSA Virtual Annual Meeting, "Relationships between soil health indicators and soil temperature and moisture status," ASA, CSSA, SSSA. (November 9, 2020).
5. Russell W. Gesch, M. Scott Wells, Julija A. Cubins and Yesuf Assen Mohammed. 2020. Challenges Establishing oilseed cash cover crops after grain corn in the Upper Midwest. 2020 ASA-CSSA-SSSA International Annual Meetings, Nov. 9-13, 2020, Virtual.
6. Liu, S, H Rusch, G Johnson, JS Strock, and A Garcia y Garcia. 2020. Water use o crops in diversified rainfed agroecosystems in the upper Midwest. ASA-CSSA-SSSA International Annual Meetings.
<https://scisoc.confex.com/scisoc/2020am/prelim.cgi/Paper/128644>
7. Yesuf Assen Mohammed, Russ Gesch, M. Scott Wells, Swetabh Patel, Andrew W. Lenssen, Burton L. Johnson, Heather Matthees, Frank Forcella and Marisol T. Berti. 2020. Impact of

- interseeded winter cover crops on soil nitrate in corn-soybean cropping systems. 2020 ASA-CSSA-SSSA International Annual Meetings, Nov. 9-13, 2020, Virtual.
8. Mulla, D., D. Wheeler, B. Gelder, L. Olmanson, B. Dalzell, and M. Drewitz. Assessing Soil Residue Cover, Cover Crops, and Erosion Using Remote Sensing and Modeling. MN Water Resources Conf. St. Paul, MN. Oct. 20, 2020.
 9. Perrone, S. Validating NRCS Dynamic Soil Health Indicators in a Silt Loam Soil in Southern Minnesota. Oral Presentation at ASA-CSSA-SSSA Annual Meeting, November 10, 2020, Virtual.
 10. Sabbagh M, Wilson ML, Pagliari PH. 2020. The Impacts Cover Crops and Liquid Manure Have on Soil Health in the Upper Midwest. In: ASA, CSSA and SSSA International Annual Meetings (2020). Virtual 8-11 Nov.
 11. Wayment, J., F.G. Fernández, V. Sharma, and J.M. Baker. 2020. Nitrate leaching reduction in corn-soybean irrigated sands with kura clover and winter rye covers. In: Annual Meetings Abstracts. ASA, CSSA, and SSSA, Madison, WI.

Ongoing research studies

1. Cates/Lewandowski: The Minnesota Cover Crop Guide, funded by MN Department of Agriculture
2. Cates/Miller: Minnesota Department of Agriculture, "Evaluating erosion and yield in different tillage regimes after a winter-killed cover crop in SW Minnesota".
3. Cates: Watershed Innovation Program, "Investigating whether soil health systems improve field workability and quality of life".
4. Fernandez: Nitrate leaching reduction in corn-soybean and continuous corn in irrigated sands with kura clover and winter rye covers.
5. DeJong-Hughes: Integrating Cover Crop and Strip Tillage to Improve Soil Health by Minimizing Wind Erosion and Nutrient Losses in Production-scale Sugarbeet Fields – Year 2
Project Description: Evaluate new practices to integrate strip tillage and cover crops to improve soil health.
6. Gamble/Jungers/Gutknecht: Forever Green Initiative funded research project studying the impact of a corn-camelina-soybean double cropping system vs an alfalfa-intermediate wheatgrass system on field-scale C balances, water-use efficiency, and soil health
7. Garcia y Garcia: Cover crop termination timing. SARE Mini Grant (co-PI with Liz Stahl)
8. Garcia y Garcy and Stahl: Cover crop options planted mid-season –2nd year at the SWROC in Lamberton
9. Garcia y Garcia: The Cover Crops, Water, and Nitrogen Nexus: How do They Impact Corn and Soybean Production and the Environment? June 27, 2016, June 30, 2021. Minnesota Department of Agriculture (PI)
10. Garcia y Garcia: Impact of cover crop strategies on productivity of corn. March 31, 2016 – October 1, 2020. Minnesota Corn Research & Promotion Council (PI)
11. Grossman: OREI (2016-2020). *A multi-regional approach for sustained soil health in organic high tunnels: nutrient management, economics, and educational programming.*
12. Field trials were completed for our cropping systems experiment, which examined the trade-offs associated with the integration of a winter legume cover crop in rotation with tomatoes, emphasizing soil and crop quality, nutrient retention, and cost effectiveness. In addition, we

completed a second replicated field experiment identifying cover crop species and planting date combinations that produce optimal nitrogen management during narrow windows of planting time in each of our three study regions (MN, KY, and KS). Sample processing and data analysis will soon be finished and compiled in peer-reviewed publications, including six planned for the biophysical data (soils, plants) and two for the economic analysis.

13. Grossman: SARE/CIG Summer Cover Crops (2020-2023): *Maximizing Summer Cover Crop Conservation Benefits for Improved Vegetable Production*. This project explores cover crop options for integration into the main growing season in diversified vegetable rotations. We are testing legume and non-legume cover crop species and mixes in two rotational positions: before a fall broccoli crop, and after a spring lettuce crop. We are observing the stand quality and biomass production of these crops, and measuring their effects on the availability, storage, and loss of soil nitrogen, as well as their ability to attract pollinators and other beneficial insects. Field trials were initiated this year on the St. Paul campus of the UMN and at Big River Farms in Marine on St. Croix, MN.
14. Johnson: Addressing trade-offs between weed management for tall waterhemp and Palmer amaranth and integration of cover crops.
15. Johnson: Understanding the role of biomass in mediating common and tall waterhemp germination and growth
16. Johnson: Leveraging Technology and Policy to Improve Land Stewardship Outcomes in Minnesota
17. Mulla: Maps showing Minnesota agricultural land with fall cover crop emergence have been summarized by county, major watershed, and sub-watershed from 2016 through 2019. The information is based on satellite imagery taken after harvest and before snowfall. Ground-truthed samples are used during the process of interpreting the images to identify areas of live green vegetation. The Cropland Data Layer is used to remove areas identified as alfalfa, hay, forage, forest, grassland, and developed. The remaining green vegetation is assumed to be a cover crop. The project is supported by the Clean Water Fund of the Clean Water, Land & Legacy Amendment.
18. Stupar: Currently, we are testing winter pea varieties in St. Paul and Lamberton for winter hardiness in the field. We are also running cold chamber grow-outs to see which varieties perform best in terms of cold-hardiness in controlled environments and checking to see if this correlates with field performance.
19. Wilson ML, Modderman C. 2018-2021. Demonstrating innovative techniques for the integration of cover crops and manure to improve soil health in cool climates. Funded by USDA-NRCS Conservation Innovation Grant NR193A750008G001.
20. Wilson ML, Modderman C. 2019-2022. Best management practices to integrate cover crops and manure. Funded by the Minnesota Corn Research and Promotion Council.
21. Wells: IPREFER (Integrated Pennycress Research Enabling Farm & Energy Resilience) CAP research project working with multi-institutions and different disciplines. One of the major objectives of our research activities in this project is to develop best agronomic management practices how to integrated pennycress (*Thlaspi arvense* L.) in the corn-soybean cropping systems to improve on-farm economics and environmental benefits.

Extension/Education/Outreach/On-farm trials/NGO

1. Cates, A. M. , SW RSDP Natural Resources Work Group, "How much cover can you get?," SW Regional Sustainable Development Program, Minnesota, United States. (August 18, 2020).
2. Cates, A. M. , Cover Crop Field Day, "Cover Crops and Soil Health," East Otter Tail SWCD, Wadena, Minnesota, United States. (August 13, 2020).
3. Cates, A. M. , Pine county crops day, "New and improved: Midwest Cover Crops Council Decision Tool," UMN Extension, Pine City, Minnesota. (March 11, 2020).
4. Cates, A. M. , Dakota county crops day, "New and improved: Midwest Cover Crops Council," UMN Extension, Farmington, Minnesota. (March 4, 2020).
5. Cates, A. M. , Marshall Soil Health Cafe Chat, "Cover crops and soil health," UMN Extension and Corn and Soybean Growers, Warren, Minnesota. (March 3, 2020).
6. Cates, A. M. , Red Lake/Pennington Soil Health Cafe Chat, "Cover crops and soil health," UMN Extension, MN Corn and Soybean Growers, St. Hilaire, Minnesota. (March 2, 2020).
7. Cates, A. M. , Nitrogen: Minnesota's Grand Challenge and Compelling Opportunity, "Cover Crops, N Additions, and Soil Health," UMN Extension, Alexandria, Minnesota. (February 18, 2020).
8. Cates and Vetsch: Radio, Cover Crop Strategies, Improving Water Quality with Cover Crops, <https://www.covercropstrategies.com/articles/1568-podcast-improving-water-quality-with-cover-crops> (October 7, 2020)
9. Grossman: The SARE/CIG Summer Cover Crops project above is collaborating with The Food Group MN and White Earth Nation on on-farm trials and education. The Food Group's Big River Farms in Marine on St. Croix, MN, an incubator and training farm for immigrant and other under-represented farmers, is hosting full-scale field trials in 2020 and 2021. WEN was unable to host the trial as planned in 2020 due to covid-related travel restrictions, but planted demonstration/preview plots of the cover crops, and will host the trial in 2021. Additionally, Natalie Hoidal and Naomy Candelaria produced an Extension educational video for growers on how to measure cover crop biomass production.
10. Fernández, F.G., and J. Wayment. 2020. Nitrogen management for irrigated corn with a winter rye cover crop and kura clover living mulch. Research Project Highlight. Univ. of Minnesota Extension https://drive.google.com/file/d/1HQxJ_0TmevZ6HCFLyK9if2uAu8oCT0oZ/view
11. Fernández, F.G., and P. McDivitt. 2020. Nitrogen study looks at two cover crops' potential to reduce nitrate leaching. In: Minnesota Crop News. Posted on 15 October 2020. <https://blog-crop-news.extension.umn.edu/2020/10/nitrogen-study-looks-at-two-cover-crops.html>
12. Fernández, F.G. 2020. Lessons from current nitrogen management research projects in irrigated corn. 2020. Becker Irrigated Research Online Field Tour at the Univ. of Minnesota Sand Plain Research Farm, Becker, MN. 27 August 2020. (42 attendees). <https://www.youtube.com/watch?v=4n1c4sW3Q2g&feature=youtu.be>
13. Fernández, F.G., and J. Wayment. 2020. Nitrogen management for irrigated corn with a winter rye cover crop and kura clover living mulch. Rosholt Farm Online Agronomy Day, Westport, MN. 20 August 2020. (150 attendees).
14. Johnson, G. Cover Crop Research Update. SROC Agronomy Field Day (Virtual). 7/1/20
15. Johnson, G. Cover Crop Field Day. UofM SW Extension group (Virtual). 8/18/20
16. Land Stewardship Project: worked with 890 landowners and farmers in the year 2020. We recently sent out a soil health survey and 132 farmers responded to let us know that they have

made soil health changes on 34,968 acres of land since 2015. Of the 34,968 acres, 18,452 were in cover crops.

17. Sabbagh M, Wilson ML. 2020. Integrating cover crops and manure: Best management practices. In: MN Ag Expo. Mankato, MN. 22-23 Jan.
18. Soil Health Coalition : Monthly radio spots KNUJ/SAM, Prairie Creek Seed Forage Tour, Bi-monthly Podcasts, Tri-State Neighbor articles, AgExpo Booth, Pomme de Terra Watershed Soil Health Meeting, Pheasant Fest, Growing Your Bottom Line, Making Lemonade from Last Years Lemons, Farm Economics, Implementing Soil Health, Dirt & Doughnuts, Soil Health Summit, Watershed & Climate Summit, Taking a Peak Under the Covers, Soil Health Economics Forum planning committee, Crop Watch Tri-State Neighbor bi-monthly, Dakota Lakes Research Farm Tour, Fridays on the Farm, Cover Crop Production Field Day, Indigo Ag Field Tour, Soil Health School, Jerry and Nancy Ackermann's Field Day, NRCS Technical Advisory Committee Meeting, MN Association of Soil and Water Conservation Districts Area VII Meeting, Soil Management Summit breakout session, SFA Conservation Highlights
19. Stahl, L.A.B. "Designing a Weed Management Program for a Corn/Soybean + Cover Crop System", MN Board of Water and Soil Resources Tech Talks, 8/10/20. (16 attendees live) Available at <https://www.screencast.com/t/LYXnr1Ba>.
20. Stahl, L.A.B. Strategic Farming Program: Optimizing Management for 2020. ONLINE – Session on "Cover Crops: Matching your management strategies and goals. (61 attendees).
21. Stahl, L.A.B. Virtual Cover Crop Field Day: Setting Up For Success ONLINE 8/18/20. 97 attendees, video online, 284 views as of 2/11/21. Available at: <https://extension.umn.edu/soil-and-water/cover-crops>
22. Stahl, L.A.B. Private Pesticide Applicator Recertification in MN – has a module on "Herbicide Persistence and Interactions with Cover Crops" (by Liz Stahl) as part of optional information to include
23. Stahl, L.A.B. Presentations at the Soil Management Summit including
24. "60-inch corn and cover crops", Soil Management Summit, breakout session
25. Weed Management and Cover Crops – Expectations and Tradeoffs presentation by Liz
26. Stahl, L.A.B. Successful Farming TV shoot with Liz for the Weeds Playbook program cover crop series 9/10. Planning for a 5-part series to be used in 2021
27. Stahl, L.A.B. Take Action Network interview with Liz– cover crops and weed management: <https://iwilltakeaction.com/news/cover-crops-more-than-just-weeds-in-the-field>
28. Stahl, L.A.B. Numerous radio spots on regional radio stations including KDOM out of Windom, KKOJ out of Jackson, and KSUM out of Fairmont
29. Stahl, L.A.B. North Central Weed Science Society Annual meeting ONLINE – moderated a chat room on cover crops (12/1/20)
30. Wilson ML. 2020. Manure happens – taking credit and covering it up. In: AGVISE 2020 Seminars. Granite Falls, MN; Watertown, SD; Grand Forks, ND. 7-9 January.
31. Wilson ML. 2020. Manure research and climate change. In: MN House Agriculture, Food, Policy Committee. 2020 January 27. Topic: How is Extension helping farmers adapt to climate change?

Others

1. Fernández, F.G. 2020. Meeting crop production and environmental quality goals through nutrient and crop management. Newcastle University School of Natural and Environmental Sciences Seminar Series. Newcastle upon Tyne, United Kingdom. 10 March, 2020.
2. Fernández, F.G. 2020. Improved crop production to feed the increasing world population while minimizing environmental impact. Rothamsted Research Seminar Series. Harpenden, United Kingdom. 3 March, 2020.
3. Fernández, F.G. 2020. The nitrogen conundrum: Improved crop production while minimizing environmental impact. University of Copenhagen Department Research Seminar. Copenhagen, Denmark. 18 February, 2020.
4. Fernández, F.G. 2020. Is it possible to meet crop production and environmental quality goals through nitrogen management alone? University of Lleida Department Research Seminar. Lleida, Spain. 30 January, 2020.
5. Fernández, F.G. 2020. Nitrogen management for corn production and environmental quality in the US Midwest. University of Bologna Research Seminar. Bologna, Italy. 13 January, 2020.