# Annual Report for NC\_old1195 for 2020-2021

# Publications, Conference papers, and Grants

**Project/Activity Number:** NC\_old1195

**Project/Activity Title:** Enhancing nitrogen utilization in corn based cropping systems to increase yield, improve profitability and minimize environmental impacts

**Period Covered:** March 7, 2020 to March 2, 2021

**Date of this Report:** May 02, 2020

**Annual Meeting Date(s):** March 2-3, 2021

**Journal Publications**

1. Bean, G.M., N.R. Kitchen, K.S. Veum, J.J. Camberato, R.B. Ferguson, F.G. Fernández, D.W. Franzen, C.A.M. Laboski, E.D. Nafziger, J.E. Sawyer, and M. Yost. 2020. Relating four-day soil respiration to corn nitrogen fertilizer needs across 49 US Midwest fields. *Soil Science Society of America Journal* 84: 1195-1208.
2. Clark, J.D., F.G. **Fernández**, J.J. Camberato, P.R. Carter, R.B. Ferguson, D.W. Franzen, N.R. Kitchen, C.A.M. Laboski, E.D. Nafziger, J.E. Sawyer, and J.F. Shanahan. 2020. Weather and soil in the US Midwest influence the effectiveness of single- and split-nitrogen applications in corn production. *Agronomy Journal* 112: 5288-5299. *Note: This article was featured in an article in the Crops and Soils Magazine (Sep. 2020) of the Am. Soc. Agron.*
3. Clark, J.D., F.G. **Fernández**, K.S. Veum, J.J. Camberato, P.R. Carter, R.B. Ferguson, D.W. Franzen, D.E. Kaiser, N.R. Kitchen, C.A.M. Laboski, E.D. Nafziger, C.J. Rosen, J.E. Sawyer, and J.F. Shanahan. 2020. Soil‐nitrogen, potentially mineralizable‐nitrogen, and field condition information marginally improves corn nitrogen management. *Agronomy Journal* 112: 4332-4343. *Note: This article was featured in an article in the Crops and Soils Magazine (Nov. 2020, pg. 20) of the Am. Soc. Agron.*
4. Clark, J.D., F.G. **Fernández**, , K.S. Veum, J.J. Camberato, P.R. Carter, R.B. Ferguson, D.W. Franzen, D.E. Kaiser, N.R. Kitchen, C.A.M. Laboski, E.D. Nafziger, C.J. Rosen, J.E. Sawyer, and J.F. Shanahan. 2020. Adjusting corn nitrogen management by including a mineralizable‐nitrogen test with the preplant and presidedress nitrate tests. *Agronomy Journal* 112: 3050-3064. *Note: This article was featured in an article in the Tri-Society CSA News Magazine.*
5. Clark, J., K.S. Veum; F.G. **Fernández**, N.R. Kitchen; J.J. Camberato, P.R. Carter, R.B. Ferguson, D.W. Franzen, D.E. Kaiser, C.A.M. Laboski, E.D. Nafziger, C.J. Rosen, J.E. Sawyer, and J.F. Shanahan. 2020. Soil sample timing, nitrogen fertilization, and incubation length influence anaerobic potentially mineralizable nitrogen. *Soil Science Society of America Journal* 84:627–637.
6. Larson, J.A., M. Stefanini, X. Yin, C.N. Boyer, D.M. Lambert, X.V. Zhou, B.S. Tubaña, P. **Scharf**, J.J. Varco, D.J. Dunn, H.J. Savoy, and M.J. Buschermohle. 2020. Effects of Landscape, Soils, and Weather on Yields, Nitrogen Use, and Profitability with Sensor-Based Variable Rate Nitrogen Management in Cotton. *Agronomy* 10 (12), 1858.
7. Leuthold, S., M. Salmeron, O. Wendroth, and **H. Poffenbarger**. 2021. Cover crops decrease maize yield variability in sloping landscapes through increased water during reproductive stages. *Field Crops Research 265*: 108111.
8. **McDaniel**, M.D., Walters, D.T., Bundy, L.G., **Li**, X., **Sawyer**, J.E., Castellano, M.J., **Laboski**, C.A.M., **Scharf**, P.C., **Drijber**, R.A., and **Horwath**, W.R. 2020. Combination of biological and chemical soil tests best predict maize nitrogen response. *Agronomy Journal* 112(2): 1263-1278
9. Li, X., Xu, S., Neupane, A., Abdoulmoumine, N., DeBruyn, J.M., Walker, F., and **Jagadamma.** **S**. 2021. Co-application of biochar and nitrogen fertilizer reduced nitrogen losses from soil. *Plos ONE, 16(3): e0248100*.
10. Li, X., Neupane, A., Xu, S., Abdoulmoumine, N., DeBruyn, J.M., Walker, F., and **Jagadamma.** **S.** 2021. Application methods influence biochar–fertilizer interactive effects on soil nitrogen dynamics. *Soil Science Society of America Journal*, 84: 1871-1884.
11. Nigon, T.J., C. Yang, G.D. Paiao, D.J. Mulla, J.F. Knight, and F.G. **Fernández**. 2020. Prediction of early season nitrogen uptake in maize using high resolution aerial hyperspectral imagery. *Remote Sensing* 12: 1234. doi:10.3390/rs12081234
12. Paiao, G.D., F.G. **Fernández**, J.A. Spackman, D.E. Kaiser, and S. Weisberg. 2020. Ground-based optical canopy sensing technologies for corn-nitrogen management in the upper Midwest. *Agronomy Journal* 112: 2998-3011.
13. Pfarr, C.J., M.L. Wilson, J.A. Coulter, and F.G. **Fernández**. 2020. Liquid swine manure as a sidedressed nitrogen source for corn. *Agronomy Journal* 112: 5206-5221.
14. Quinn, D., C. Lee, and **H. Poffenbarger**. 2020. Corn Yield Response to Sub-Surface Banded Starter Fertilizer in the U.S.: A Meta-Analysis. *Field Crops Research* 254: 107834.
15. Ransom, C.J., N.R. Kitchen, J.J. Camberato, P.R. Carter, R.B. Ferguson, F.G. **Fernández**, D.W. Franzen, C.A.M. **Laboski**, E.D. Nafziger, J.E. **Sawyer**, P.C. **Scharf**, and J.F. Shanahan. 2020. Corn nitrogen rate recommendation tools’ performance across eight U.S. Midwest Corn Belt states. *Agronomy Journal* 112: 470-492.
16. Sassman, A.M., D.W. Barker, J.P. Lundvall, and J.E. **Sawyer**. 2020. Evaluation of fall applied liquid swine manure with encapsulated nitrapyrin. *Soil Science Society of America Journal* 84:1751-1768. DOI:10.1002/saj2.20099.
17. **Sawyer**, J.E., and A. P. Mallarino. 2020. Soil Fertility. *In* Field Crop Production Handbook, An Introduction to Farming Practices. P. 63-72. Iowa State Univ. Ext. and Outreach CROP 3162. Ames.
18. Spackman, J.A., and F.G. **Fernández.** 2020. Microplot design and plant and soil sample preparation for nitrogen analysis. *Journal of Visualized Experiments* 159: e61191. doi:10.3791/61191. <https://www.jove.com/v/61191/microplot-design-plant-soil-sample-preparation-for-15nitrogen>
19. Wade, J., S. Culman, J.A.R. Logan, **H. Poffenbarger**, M.S. Demyan, **J.H. Grove**, A.P. Mallarino, J.M. McGrath, M. Ruark, and J. West. 2020. Improved soil biological health increases corn grain yield in N fertilized systems across the Corn Belt. *Scientific Reports* 10(1):3917.
20. Yuan, M., F.G. **Fernández**, C. Pittelkow, K.D. Greer, and D. Schaefer. 2020. Soil and crop response to phosphorus and potassium management under conservation tillage. *Agronomy Journal* 112: 2302-2316.

**Conference presentations**

1. Cummings, C., G.D. Paiao, S. Kang, Y. Miao, F.G. **Fernández**. 2020. Improving in-season estimation of corn nitrogen status using crop circle phenom sensor and machine learning. In: 15th International Conference on Precision Agriculture, Minneapolis, MN. 28 Junio-1 July, 2020.
2. **Jagadamma, S.,** and Kramer, A. 2020. Cover crops: nutrient release and soil health. University of Tennessee Fertilizer Update Meeting (Virtual), Dec 8.
3. Kang, S., Y. Miao, C.J. Ransom, F.G. **Fernández**, and N.R. Kitchen. 2020. Coupling crop growth modeling and proximal sensing for precision nitrogen management of corn. In: 15th International Conference on Precision Agriculture, Minneapolis, MN. 28 Junio-1 July, 2020.
4. Li, D., Y. Miao, F.G. **Fernández**, N.R. Kitchen, C.J. Ransom, J.J. Camberato, P.R. Carter, R.B. Ferguson, D.W. Franzen, C.A.M. Laboski, E.D. Nafziger, J.E. Sawyer, and J.F. Shanahan. 2020. Developing an innovative in-season and site-specific nitrogen recommendation strategy with machine learning for US Midwest corn production. In: 15th International Conference on Precision Agriculture, Minneapolis, MN. 28 Junio-1 July, 2020.
5. Menegaz, S.T., and F.G. **Fernández**. 2020. Nitrogen source and application timing for corn to mitigate leaching and gaseous N losses. In: Proc. of the 50th Annual North Central Extension-Industry Soil Fertility Conference. Online Conference. 18-19 November 2020. <https://northcentralfertility.com>.
6. Menegaz, S.T., and F.G. **Fernández**. 2020. Nitrogen source and time of application: can these variables help us improve corn production? In: Annual Meetings Abstracts. ASA, CSSA, and SSSA, Madison, WI.
7. Menegaz, S.T., F.G. **Fernández**, P.H. Pagliari, and R. Venterea. 2020. Nitrate leaching and nitrous oxide and ammonia emissions from different nitrogen sources and application timing on continuous corn. In: Annual Meetings Abstracts. ASA, CSSA, and SSSA, Madison, WI.
8. Menegaz, S.T. and F.G. **Fernández**. 2020 Application timing and nitrogen sources to mitigate subsurface nitrate leaching, and nitrous oxide and ammonia gas emissions. In J. Strock, Editor, Proceedings of the 7th Soil and Water Management Field Day. Southwest Research and Outreach Center. Lamberton, MN. p. 10-17. (78 attendees at the time the online field day was recorded). <https://www.youtube.com/watch?v=99qcQqCbuOc>
9. Miao, Y., D. Li, F.G. **Fernández**, N.R. Kitchen, C. Ransom, J.J. Camberato, P.R. Carter, R.B. Ferguson, D.W. Franzen, C.A.M. Laboski, E. Nafziger, J.E. Sawyer, and J. Shanahan. 2020. Developing an innovative in-season and site-specific nitrogen recommendation strategy with machine learning for us Midwest corn production. In: Annual Meetings Abstracts. ASA, CSSA, and SSSA, Madison, WI.
10. Paiao. G.D., F.G. **Fernández**, and S.L. Naeve. 2020. Soil drainage and tillage practice affect nitrogen management and soil nitrogen. In: Annual Meetings Abstracts. ASA, CSSA, and SSSA, Madison, WI.
11. Paiao, G.D., and F.G. **Fernández.** Estimating greensnap yield damage with canopy reflectance: a case study. In: African Conference on Precision Agriculture, Marrakech, Morocco. 8-10 December, 2020.
12. Paiao, G.D., F.G. **Fernández**, T.J. Nigon, C. Cummings, and S.L. Naeve. 2020. Estimating greensnap yield damage with crop canopy reflectance: A case study. In: Annual Meetings Abstracts. ASA, CSSA, and SSSA, Madison, WI.
13. Paiao, G.D., and F.G. **Fernández**. 2020. Hyperspectral aerial imaging for determination of corn nitrogen status. In: 15th International Conference on Precision Agriculture, Minneapolis, MN. 28 Junio-1 July, 2020.
14. **Poffenbarger, H.J.** and S. Leuthold. Understanding and addressing spatial variability in corn yield. University of Kentucky Corn, Soybean, and Tobacco Field Day. Princeton, KY, July 2020.
15. **Poffenbarger, H.J.** 2020. Legacy effects of nitrogen inputs on corn productivity and fertilizer nitrogen use efficiency. Indiana CCA conference. Indianapolis, IN, December 2020.
16. Ramirez II, S., 2020. Response of soil biological properties to crop diversity, residue management and N fertilization in long-term maize cropping systems of Eastern Nebraska. PhD Dissertation, University of Nebraska-Lincoln. (**Drijber** served as committee member).
17. **Russell**, A.E. and Dailey, J.K., 2020. Gaming Ag Nitrogen Cycling. *Teaching Issues and Experiments in Ecology*, Vol. 16, Experiment #2. <https://tiee.esa.org/vol/v16/experiments/russell/abstract.html>
18. **Scharf, P.C.** 2020. Corn, rye, and nitrogen. Presented at the Northwest Missouri CCA Conference, St. Joseph, MO, January 22, 2020.
19. **Scharf, P.C.** 2020. Balancing Nutrients on the Farm: Synthetic vs. Litter. Presented at the Dade County Soils & Crops Conference, January 23, 2020.
20. **Scharf, P.C.** 2020. 35 years of nitrogen research. Presented at the North Central Extension-Industry Soil Fertility Conference, November 18, 2020.
21. **Scharf, P.C.** 2020. 35 years of nitrogen research. Presented at the Missouri Crop Management Conference, December 2, 2020.
22. Sharma, V., G. Singh, F.G. **Fernández**, M. Tahir, D.J. Mulla, 2020. Evaluation and performance of different irrigation scheduling methods and their impact on corn production and nitrate leaching in Central Minnesota. In: American Society of Agricultural and Biological Engineers (ASABE) International Annual Conference, Virtual. 13 July 2020.
23. Singh, G., V. Sharma, D.J. Mulla, M. Tahir, and F.G. **Fernández**. 2020. Irrigation management impact on corn yield and nitrate leaching. In: Annual Meetings Abstracts. ASA, CSSA, and SSSA, Madison, WI.
24. Spackman, J.A., and F.G. **Fernández**. 2020. Corn uptake of soil- and fertilizer-derived nitrogen in response to rate and timing of fertilizer application. In: Proc. of the 50th Annual North Central Extension-Industry Soil Fertility Conference. Online Conference. 18-19 November 2020. <https://northcentralfertility.com>.
25. Spackman, J.A., and F.G. **Fernández**. 2020. Nitrogen enriched urea fertilizer recovery by corn on Upper Midwest soils. In: Annual Meetings Abstracts. ASA, CSSA, and SSSA,
26. Spackman, J.A., and F.G. **Fernández**. 2020. Soil cycling dynamics of 15n enriched urea on Upper Midwest soils. In: Annual Meetings Abstracts. ASA, CSSA, and SSSA, Madison, WI.
27. 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>.
28. 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.

**Grants awarded or ongoing in 2020**

1. Coble, K.H. (PI), Harri, A., **Li**, X., and Park, E. Redesigning farm policy in an era of digital agriculture. USDA NIFA-AFRI, 2018-2022, $479,336.
2. **Drijber**, R. (PI). Soil Response to Agricultural Intensification, Dept of Agriculture-ARS, Federal, Research, 2019-2024, ($150,000).
3. **Drijber**, R. (PI). Enhancing nitrogen utilization in corn based cropping systems to increase yield, improve profitability and minimize environmental impacts. 2016-2021, ($50,000).
4. **Fernández,** F.G. (PI).Minnesota Agricultural Fertilizer Research and Education Council
5. Coordinated educational program for nutrient management in Minnesota. 2020-2021. $16,491
6. **Fernández,** F.G. (PI), Kaiser, D., Vetsch, J., Strock, J., Pagliari, P., Pease, L., Rosen, C., Miao, Y., Sims, A., and Wilson, M. Minnesota Agricultural Fertilizer Research and Education Council. Long-term impact of nitrogen fertilization on corn production, soils, and nitrogen cycling processes in Minnesota. 2020-2021. $109,165
7. **Fernández,** F.G. (PI).Minnesota Department of Agriculture. Nitrogen and water quality with and without cover crops and living mulches in irrigated corn in Pope County, Minnesota. 2021-2022. $214,500
8. **Fernández,** F.G. (PI).Minnesota Agricultural Fertilizer Research and Education Council.
9. Coordinated educational program for nutrient management in Minnesota. 2021-2022. $16,000
10. **Fernández,** F.G. (PI), Kaiser, D., Vetsch, J., Strock, J., Pagliari, P., Pease, L., Rosen, C., Miao, Y., Sims, A., and Wilson, M. Minnesota Agricultural Fertilizer Research and Education Council. Long-term impact of nitrogen fertilization on corn production, soils, and nitrogen cycling processes in Minnesota. 2021-2022. $94,545
11. **Fernández,** F.G. (PI), Sharma, V., and Garcia y Garcia, A. University of Minnesota Water Resources Center Watershed Innovations (WINS) Program. Nitrogen rate, cover crops, and living mulches: Their impact on irrigated corn and soybean production and the Environment. 2021-2024. $124,820
12. **Fernández,** F.G. (PI), and Lazarus, B. Minnesota Agricultural Experiment Station Rapid Agricultural Response Fund. Controlled-release nitrogen and split applications to enhance corn production and environmental protection. 2021-2023. $369,590 [$364,590 to **Fernández**]
13. Gish-Hill, C. (PI),and **McDaniel**, M.D. Reuniting the three sisters: native american intercropping and soil health. North Central Regional - Sustainable Agriculture Research & Education (SARE), $200,000, 11/1/2019–10/31/2021.
14. Gish-Hill, C. (PI), **McDaniel**, M.D., Winham, D., and Nair, A. Reuniting the three sisters: enhancing community and soil health in Native American communities. United States Department of Agriculture – National Institute of Food and Agriculture – Critical Agricultural Research and Extension (CARE), $300,000, 7/1/2019–6/30/2022.
15. Haramoto, E. (PI), and **Poffenbarger**, H.J. Investigating cereal rye varieties for improved cover crop performance. Kentucky Small Grain Growers’ Association Research Grant. 9/18-8/19. Renewed 9/19-9/20. $35,000.
16. **Jagadamma**. S. (PI). Cover crops, nitrogen, soil health, and farm profitability, Tennessee Department of Agriculture, 2020-2021 ($72,000)
17. **Jagadamma**, S. (PI), Walker, F., Singh, S., Duncan, L., McClure, A., and Upendram, S. Demonstrating the impacts of cover crops for soil health and farm profitability in Tennessee. Tennessee Department of Agriculture, 2019-2023, $341,493
18. **Jagadamma**, S. (PI), Lee, J., Duncan, L., McClure, A., Raper, T., and Kivlin, S. Optimizing plant-soil-microbial interactions through crop diversification to enhance sustainability in southeastern croplands. USDA-AFRI, 2020-2024, $500,000
19. **Laboski**, C.A.M.(PI). Adaptive N management strategies for corn II. Wisconsin Fertilizer Research Council, 2020-2023, ($120,957).
20. **Laboski**, C.A.M.(PI) Investigation of soil health N tests to predict corn N need. Wisconsin Fertilizer Research Council, 2020-2023, ($138,227).
21. Lee, C. (PI), **Poffenbarger**, H.J., and Wise, K. Successfully establishing corn in cover crops. Kentucky Corn Growers’ Association Research Grant. 1/19-12/19. Renewed 1/20-12/20. $80,000.
22. **McDaniel**, M.D. (PI), Davis, M.P., Zhang, W., and **Sawyer,** J.E. Investigating the double impact of soil health promoting practices on water quality. Iowa Nutrient Research Center, $170,327, 07/01/2019–06/30/2021.
23. **McDaniel**,M.D. (PI), and M. Licht. Biological seed coating’s ability to enhance plant growth and soil health. BASF, $130,700, 5/1/2019–4/30/2021.
24. McGrath, J. (PI), **Poffenbarger**, H.J., Salmeron, M., Ritchey, E., Sama, M., and Shockley, J. Kentucky Corn Growers’ Association Research Grant. Nitrogen rate decision support for Kentucky corn grain production. 2019-2020. $215,451.
25. Naeve, S. (PI), and **Fernández,** F.G.Minnesota Soybean Research and Promotion Council The UofM/MNSR&P.drainage and tillage research site: Enhancing soybean production through novel management: drainage, tillage, cover crops, and crop residue removal. 2021-2022. $50,000 [$15,000 to **Fernández**]
26. **Norton, J.M.** (PI), Reeve, J., Jones, S., Stark, S., and Habteselassie. M.Y. USDA/NIFA Climate Variability & Change, Linking nitrification to microbial community in agroecosystems under changing climate. 2016-2020
27. **Poffenbarger,** H.J. (PI), Salmeron, M., and Wendroth, O. Evaluating cover crop mixtures as precision nitrogen management tools. United States Department of Agriculture Foundational and Applied Program Grant. 2020-2025. $499,522 (299,713).
28. **Poffenbarger**, H.J. (PI), and McNear, D. Getting to the root of the matter: Linking root traits to soil health. United States Department of Agriculture Foundational and Applied Program Grant. 2019-2023. $499,040.
29. **Poffenbarger**, H.J. (PI) and Leuthold, S. Investigating the effects of grass-legume winter cover crop mixtures on soil nitrogen supply in rolling cropland. Southern Sustainable Agriculture Research and Education Graduate Research Grant. 2019-2021. $16,500.
30. **Poffenbarger**, H.J. (PI), Leuthold, S., Wendroth, O., Salmeron, M., and Haramoto, E. Understanding subfield variation in corn nitrogen fertilizer needs. Kentucky Corn Growers’ Association Research Grant. 1/7/2020-1/6/2021. $12,000.
31. **Poffenbarger**, H.J. (PI), and Van Sanford, D. Investigating the impact of soil properties on wheat flavor. College of Agriculture, Food, and Environment Research Activity Award. 10/2019-6/2020. $1,500.
32. Reberg-Horton, C. (PI), Mirsky, S.B., **Poffenbarger**, H.J., and Haramoto, E, et al. (46 total investigators). A cover crop network for enhancing the sustainability of U.S. cropping systems. United States Department of Agriculture Sustainable Agricultural Systems Grant. 2019-2024. $10,000,000.
33. Pagliari, P.H. (PI), **Fernández,** F.G., and Kaiser, D.E. Minnesota Agricultural Fertilizer Research and Education Council. Assessment of atmospheric deposition of nutrients in Minnesota. 2020-2021. $38,500 [$1,000 to **Fernández**]
34. Pease, L. (PI), Cates, A., **Fernández,** F.G., and Strock, J. Minnesota Agricultural Fertilizer Research and Education Council. Quantifying soil carbon, nitrogen, and phosphorus after subsurface drainage installation. 2020-2021. $90,686 [$2,000 to **Fernández**]
35. Salmeron Cortasa, M. (PI), **Poffenbarger**, H.J., and Boote, K. Network for evaluating and improving soybean crop models and their role in environmental impact and sustainability of agronomic systems. United States Department of Agriculture Foundational and Applied Program Grant. 2019-2022. $500,000.
36. Sharma, V. (PI), and **Fernández,** F.G., and Miao, Y. Minnesota Agricultural Fertilizer Research and Education Council. Effect of variable irrigation and nitrogen fertilizer rates on crop water productivity and water quality. 2020-2021. $90,000 [$5,000 to **Fernández**]
37. Sharma, V. (PI), Mulla, D., and **Fernández**, F.G. Minnesota Department of Agriculture. Evaluation and performance of different irrigation scheduling methods and their impact on corn production and nitrate leaching in central sands region of Minnesota. 2019-2021. $124,005 [35,000 to **Fernández**]