

NCCC-211 MINNESOTA: Cover crops to improve agricultural sustainability and environmental quality in the upper Midwest

Research Projects:

Southeast Minnesota Cover Crop and Soil Health Initiatives funded by the Environment and Natural Resources Trust Fund with recommendation from the LCCMR. Partners include: Minnesota Board of Water & Soil Resources, Minnesota Technical Service Area 7, and the University of Minnesota. Summary: Southeast Minnesota has a unique situation geologically and hydrologically with the result being that they are seeing elevated water quality issues in both ground and surface waters. This project will work with numerous farmer-cooperators in an 11 county area of southeastern Minnesota to develop 2-year demonstration acres as well as an economic analysis on cover crops. Numerous field days and workshops will highlight the farmer projects as well as bring in University research and University, non-profit, farmer, agency guest speakers. Contact: Jill Sackett Eberhart sacke032@umn.edu

Reducing Manure Nutrient Loss with Cover Crops funded by Fund: EPA-319 grant through the MN Pollution Control Agency. Project duration 11/2015 to 8/2019. Summary: The objectives are to 1. Determine corn silage or grain yield following fall planted cereal rye cover crop compared to no cover crop, when fall applied manure is the nitrogen source. 2. Determine the amount of nitrogen sequestered by the cover crop in the fall and the spring. 3. Determine the nitrogen uptake by the following corn crop, with and without a cover crop. The treatments are liquid manure fall-injected into plots with and without a fall planted cereal rye cover crop, followed by spring termination of the cover crop and planting of corn for silage or grain. Contact: Leslie Everett, ever003@umn.edu

Demonstration and regional adaptation of interseeded cover crop planting and management technologies in annual corn cropping systems in the Upper Midwest funded by NRCS-CIG program. Duration 2016 – 2019. Summary: The objectives of this project are 1. Providing a framework for transfer of technologies through extension education, 2. Demonstrate successful establishment of a range of cover crop species interseeded into standing corn using a high-clearance drill at two critical planting dates corresponding to corn stages V2 and V7 (two and seven leaf-collar stages, respectively), and 3. Expose Minnesotan farmers to the winter oilseed-soybean relay cropping system. Contact: M. Scott Wells, mwells@umn.edu

On-Farm Evaluation of Annual Forage Crops for Cover Crop Forage. Funded by Midwest Forage Association, MN. Duration 2014 – 2016. Summary: Screening of 10 cover crop species for use as forage production systems. Species were mechanically harvested and assessed for total forage biomass and relative feed quality. Contact: Jim Paulson, jcp@umn.edu

What is the value of Nitrogen? Funded by SARE. Duration 2015-2019. Summary: How much Nitrogen does a Cereal Rye cover crop scavenge before a corn vs soybean crop is planted (cereal rye will be grown longer before planting soybeans) and when (that following season) does that cereal rye release most of its Nitrogen to the cash crop? Contact: Myles Elsen, Myles.Elsen@mn.usda.gov

Greening the brown period of the corn and soybean rotation with self-perpetuating winter annual and perennial cover crop systems, funded by Minnesota Department of Agriculture. Duration 2015 – 2019. Summary: The products we anticipated by the project are 1. New management techniques that maintain continuous living cover in Minnesota corn and soybean 2. New cropping systems that produce biofuel feed stocks without reducing corn and soybean yields 3. Reduction in negative consequences of annual row cropping on field and regional scales, and 4. Addition of wildlife habitat and pollinator resources to the Minnesota landscape. Contact: Don Donald Wyse, wysex001@umn.edu

Forever Green Initiative Clean Water Land & Legacy Amendment funding \$1 million to the University of Minnesota for FY 2016:

- Anderson, Jim Intermediate Wheatgrass Breeding Support using Phenotypic and Genotypic-based Selection Methods \$51,615
- Chen, Senyu Population Dynamics of Soybean Cyst Nematode in Winter Annual Oilseeds \$94,424
- Sheaffer, Craig Advanced management practices for enhancing profitability of intermediate wheatgrass \$98,233
- Ismail, Baraem Effect of Refinement and Dough Conditioners on the Quality of Intermediate Wheatgrass for Food Applications \$125,000
- Anderson, Jim 2 Field Pennycress Breeding Project Support \$90,132
- Wells, M. Scott Agronomics Development of Winter Annual Oilseeds in a Field Corn Production System \$149,764
- Brandvain, Yaniv Developing Genomic Resources for Helianthus divaracatus to facilitate the development of perennial sunflower for food production and wildlife services \$80,652
- Braun, Lois Sustaining Hazelnut Breeding and Agronomic Research at the University of Minnesota \$80,000
- Cohen, Jerry Advancing hazelnut micro-propagation \$125,000
- Johnson, Gregg Integrating winter annual cover crops into corn and soybean rotations in Minnesota \$55,180
- Garcia y Garcia, Axel Effect of Cover Crops on Water Use and Nitrogen Leaching in Corn and Soybean Cropping Systems \$50,000

Education:

Paulson, J. 2015. Fitting cover crops to your farm. Presented at Central MN Farm Show (32 in attendance); Winter crop day, Winona county; Goodhue county SWCD cover crop day (80 in attendance); IEFAC meeting, Lacrosse, WI (20 in attendance). University of Minnesota.

Paulson, J. 2015. Choosing which cover crops to use. Land Stewardship Program field day, Olmsted county (25 in attendance).

Paulson, J. 2015. Cover crops for forage, Winona county fall crop day on managing nutrient loss. (18 in attendance).

Paulson J. et al. 2015. Evaluation of annual forage crops for cover crop forage in an organic system. MOSES conference, poster session. Lacrosse, WI (3,000 in attendance).

Myles, E. et al. 2015. Freeborn County Soil Health Team: Winter meetings on cover crops. (200 in attendance).

Wells, M. S. et al., 2015. Cover Crop Learning Tour, Lakefield, MN. Nancy and Jerry Ackerman hosted the University of Minnesota, NRCS, Soil Water Conservation District, and seed dealers Albert Lea Seed house, and LaCrosses Seeds. Discussions centered around soil health, and demonstrations of cover crop interseeding and strip-tillage. (125 in attendance).

Crellin, J. (NRCS ARC in Area 4) talked at the Paynesville CCA Update meeting on October 2, 2014 about cover crops to about 50 Certified Crop Advisors.

Stearns County had a Cover Crop Field Day on November 4, 2014 that had about 100 producers. Nobles County Soil Health Team held field day with Jerry Ackerman in SC MN on November 13, 2014 and had about 100 people in attendance.

Spencer C. et al., 2015. NRCS informed 80 TSPs about Soil Health and cover crops at the University of Minnesota Extension Short Course December 9, 2014.

Outcomes:

NRCS Promoted the Cover Crop Soil Health Initiative (multiple species cover crops, same acres, for 5 years) through news articles, fact sheets, and trainings. They had 54 producers sign up in 2013 with 2539.9 acres, 25 producers in 2014 with 1126.3 acres and in 2015 was the last year for the Initiative and we had 26 producers sign up with 1492.1 acres. Working with Field Offices, soil scientists, and ARCs once they have producers signed up for the initiative. In addition, 22 producers are interested in working with the University of Minnesota on getting usable data from the Initiative after the 5 years.

State Agronomist works with RMA (Risk Management Agency) to understand the Cover Crop Insurance policies so that can be relayed back to the ARCs and field offices. RMA, University of Minnesota Extension, SWCD, National Wildlife Federation, and NRCS met on September 3, 2015 to discuss changes to insurance policies to consider cover crops under good farming practices and not separately.

Publications:

Gamble, J.D., J.M. Jungers, D.L. Wyse, G.A. Johnson, J.A. Lamb, and C.C. Sheaffer. 2014. Harvest Date Effects on Biomass Yield, Moisture Content, Mineral Concentration, and Mineral Export in Switchgrass and Native Polycultures Managed for Bioenergy. *Bioenergy Res.*: 740–749.

Gieske, M.F., V.J. Ackroyd, D.G. Baas, D.R. Mutch, D.L. Wyse, and B.R. Durgan. 2016. Brassica cover crop effects on nitrogen availability and oat and corn yield. *Agron. J.* 108(1): 151–161.

Gieske, M.F., D.L. Wyse, and B.R. Durgan. 2015. Spring and Fall-Seeded Radish Cover Crop Effects on Weed Management in Corn. *Weed Technol.* (February): WT–D–15–00023.1 Available at <http://www.wssajournals.org/doi/10.1614/WT-D-15-00023.1>.

Johnson, G.A., M.B. Kantar, K.J. Betts, and D.L. Wyse. 2015. Field pennycress production and weed control in a double crop system with soybean in minnesota. *Agron. J.* 107(2): 532–540.

- Jordan, N.R., K. Dorn, B. Runck, P. Ewing, A. Williams, K.A. Anderson, L. Felice, K. Haralson, J. Goplen, K. Altendorf, A. Fernandez, W. Phippen, J. Sedbrook, M. Marks, K. Wolf, D. Wyse, and G. Johnson. 2016. Sustainable commercialization of new crops for the agricultural bioeconomy. *Elem. Sci. Anthr.* 4(1): 000081 Available at <http://www.elementascience.org/articles/81> (verified 22 February 2016).
- Jungers, J.M., T.W. Arnold, and C. Lehman. 2015a. Effects of Grassland Biomass Harvest on Nesting Pheasants and Ducks Effects of Grassland Biomass Harvest on Nesting Pheasants. *Am. Midl. Nat.* 173(1): 122–132.
- Jungers, J.M., A.T. Clark, K. Betts, M.E. Mangan, C.C. Sheaffer, and D.L. Wyse. 2015b. Long-Term Biomass Yield and Species Composition in Native Perennial Bioenergy Cropping Systems. *Agron. J.* 107(5): 1627 Available at (verified 6 February 2016).
- Jungers, J.M., J.O. Eckberg, K. Betts, M.E. Mangan, D.L. Wyse, and C.C. Sheaffer. 2015c. Plant roots and GHG mitigation in native perennial bioenergy cropping systems. *GCB Bioenergy*: n/a–n/a Available at <http://doi.wiley.com/10.1111/gcbb.12321> (verified 28 December 2015).
- Jungers, J.M., J.E. Fargione, C.C. Sheaffer, D.L. Wyse, and C. Lehman. 2013. Energy Potential of Biomass from Conservation Grasslands in Minnesota, USA. *PLoS One* 8(4).
- Jungers, J.M., C.C. Sheaffer, J. Fargione, and C. Lehman. 2014. Short-term harvesting of biomass from conservation grasslands maintains plant diversity. *GCB Bioenergy*: 1050–1061.
- Jungers, J.M., C.C. Sheaffer, and J.A. Lamb. 2015d. The Effect of Nitrogen, Phosphorus, and Potassium Fertilizers on Prairie Biomass Yield, Ethanol Yield, and Nutrient Harvest. *Bioenergy Res.* 8(1): 279–291.
- Jungers, J.M., D.L. Wyse, and C.C. Sheaffer. 2015e. Establishing Native Perennial Bioenergy Crops with Cereal Grain Companion Crops. *Bioenergy Res.* 8(1): 109–118.
- Marti, A., J.E. Bock, M.A. Pagani, B. Ismail, and K. Seetharaman. 2016. Structural characterization of proteins in wheat flour doughs enriched with intermediate wheatgrass (*Thinopyrum intermedium*) flour. *Food Chem.* 194: 994–1002 Available at <http://dx.doi.org/10.1016/j.foodchem.2015.08.082>.
- Marti, A., X. Qiu, T.C. Schoenfuss, and K. Seetharaman. 2015. Characteristics of perennial wheatgrass (*Thinopyrum intermedium*) and refined wheat flour blends: Impact on rheological properties. *Cereal Chem.* 92(5): 434–440.
- Sheaffer, C.C., K.M. Martinson, D.L. Wyse, and K.M. Moncada. 2014. Companion Crops for Organic Alfalfa Establishment. *Agron. J.* 106(1): 309 Available at <https://dl.sciencesocieties.org/publications/aj/abstracts/106/1/309> (verified 22 February 2016).
- Sackett, J. & Wells, M.S. (reviewed by: Sebastian, R.- USDA RMA & Spencer, C. – USDA NRCS) USDA Cover Crop Guidelines Updated. February 16, 2015. Minnesota Crop News (blog). <http://blog-crop-news.extension.umn.edu/2015/02/usda-cover-crop-guidelines-updated.html>
- Williams, A., D.A. Kane, P.M. Ewing, L.W. Atwood, A. Jilling, M. Li, Y. Lou, A.S. Davis, A.S. Grandy, S.C. Huerd, M.C. Hunter, R.T. Koide, D.A. Mortensen, R.G. Smith, S.S. Snapp, K.A. Spokas, A.C. Yannarell, and N.R. Jordan. 2016. Soil Functional Zone Management: A Vehicle for Enhancing Production and Soil Ecosystem Services in Row-Crop Agroecosystems. *Front. Plant Sci.* 7 Available at (verified 5 February 2016).