



Villamil – Nafziger • NREC 2014-03556
Interim Research Report IV- 07/01/14 to 12/31/14
Agronomic and Environmental Assessment of Cover Crop in Illinois

Project participants:

Dr. María Villamil and Dr. Emerson Nafziger of the Crop Sciences Department of the University of Illinois work in collaboration with our Commercial Ag Extension Educators – Robert Bellm, Dennis Bowman, Russ Higgins and Angie Peltier – and Dr. Rachel Cook from Southern Illinois University. In addition, we have recruited several farmers to participate in this project. Mr. Gevan Behnke is our lab technician, and Mr. Ivan Dozier is a MS student candidate in the Department of Crop Sciences conducting research under this project since July 2013.

Project description:

In partnership with Illinois farmers, our long-term goal is to develop environmentally-sound crop management strategies that improve nutrient use efficiency in current cropping systems and make those farms more sustainable and profitable. By utilizing on-farm and Research & Education Center (REC) trials throughout the state, we plan to evaluate relevant and location specific information that will allow a realistic assessment of the cover crop's ability to scavenge N at the landscape level.

Objectives: 1) To develop a comprehensive set of trials to look at effects of cover crops in both on-farm and REC sites, 2) To measure the effect of cover crops in scavenging N and sequestering nutrients in their biomass, 3) To evaluate the effect of cover crops on commercial crop stands and yields, and on economic returns, and 4) To evaluate the effect of tillage on crop and soil responses to cover crops.

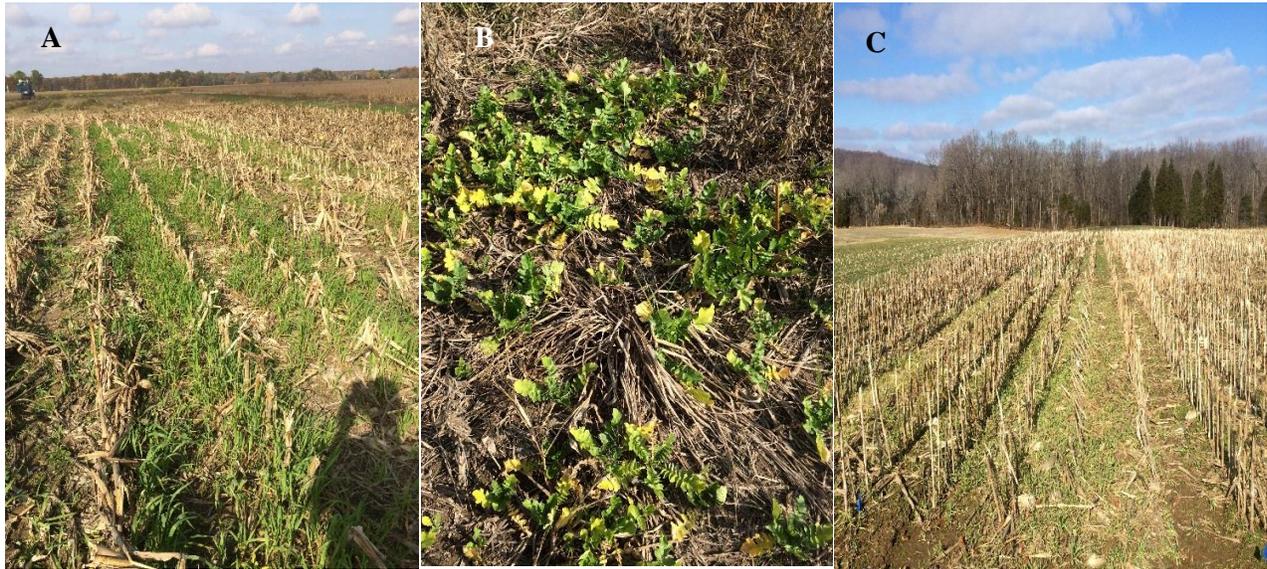
Outcomes for the period 07/01/14 to 12/31/14:

Research Centers:

- **General description:** Air temperatures around Illinois reached lows of 29 to 19°F during the 1st week of November, stressing the growth of the cold-sensitive cover crops. The temperatures remained cold for a few days, then rebounded. The 2-3rd weeks in November were very cold and most likely terminated growth for all cover crops with the exception of cereal rye at most research centers. However, at the Dixon Springs site, cover crop growth was seen into mid-December.
- **Cover crop planting** occurred during the first week of September at all sites, following the Midwest cover crop council recommendations.
- **Cover crop biomass sampling** was conducted at the Urbana site the last week of October and the first week of November as part of Mr. Ivan Dozier's MS project.
- **Cover crop growth and emergence** of all species was good at the Monmouth and Urbana sites; growth was also good at the Brownstown (A) site thanks largely to the 3.14" of rain received in the 12 days following seeding. In addition, cover crop growth at Dixon Springs, IL was excellent (B & C).



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Picture A was taken from Brownstown Research Center on October 24, 2014. Pictures B & C were taken from Dixon Springs Research Center on December 11, 2014.

- **Soil sampling** was completed at all but one research center sites during the fall of 2014; unexpectedly early freezing conditions made soil sampling difficult so one of the sites was sampled later on during the first week of December. Three subsamples per plot were taken to a depth of 90cm, and divided into 0-30, 30-60, and 60-90 cm depth increments in the lab. Samples were then sent to a commercial lab Brookside Lab (OH) for characterization of available N. Soil samples were not collected at the two southern IL sites during the fall of 2014.



Farm sites:

- **General description:** As of mid-November, the cover crop establishment at many of sites appeared good. At two of the sites near Brownstown Research Center, late harvest of corn and soybeans prevented drilling of cereal rye into the residue; this resulted in no observable cover crop emergence as of mid-December. At the site near Altona in Knox County, cover crop growth was better than in 2013 with good emergence of cereal rye and oilseed radish.
- **Farmer Cooperators:** Two additional farmer cooperators in central Illinois joined our project during the summer/fall of this year. We will continue recruiting collaborators for next cover crop season.
- **Soil sampling** was conducted at some farm sites as of now, wet conditions and late harvest have limited sampling at some of the sites. We will continue to sample into the winter months as some sites



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were too wet or frozen already in the fall. Our Commercial Ag Educators help to coordinate the soil sampling at each farm conducted by Mr. Tim Smith and his crew (www.cropsmith.com). Four subsamples per plot were taken to a depth of 90cm, divided into 0-30, 30-60, and 60-90 cm depth increments, bagged, and ship to Brookside Lab (OH) for characterization of available N and complete soil characterization of the newly established farm sites.

Challenges: The early freezing conditions in the fall of 2014 may have hampered ideal cover crop growth into the later fall, but good soil moisture and an early harvest may have led to nice growth at most sites. Some of the sites experienced delayed spring planting due to wet field conditions; this led to delayed fall harvest. If drilling cover crop seeds into residue, little to no cover crop growth resulted; this is most likely due to late harvest of cash crop and subsequent late seeding of the cover crop. These challenges are however part of our regular growing conditions here in the State and capturing these with our data collection and the length of this project will allow us to provide good answers to our producers regarding the feasibility and benefits of growing cover crops in IL.

Preliminary Results: Table 1. Dates of different sampling types by year, season, and location.

Year	2012	2013	2013	2013	2013	2014	2014	2014	2014	2014
Season	Fall	Spring	Spring	Fall	Fall	Spring	Spring	Spring	Fall	Fall
Location	Research Center	Research Center	Research Center	Research Center	On-farm	Research Center	On-farm	Research Center	Research Center	On-farm
Analysis	Soil	Soil	CC Biom	Soil	Soil	Soil	Soil	CC Biom	Soil	Soil
Brownstown	10/30/2012	No ¹	7/22/2013	9/25/2013	3 sites	3/25/2014	3 sites	5/2/2014	10/2014	3 sites
Carbondale	N/A	N/A	N/A	3/19/2014	N/A	6/6/2014	N/A	Yes	N/A	N/A
DeKalb	11/14/2012	7/11/2013	5/3/2013	12/6/2013	1 site	6/11/2014	1 site	5/22/2014	10/2014	N/A
Dixon Springs	N/A	N/A	N/A	12/18/2013	N/A	7/24/2014	N/A	Yes	N/A	N/A
Monmouth	10/30/2012	6/21/2013	5/7/2013	12/11/2013	2 sites	4/23/2014	2 sites	4/23/2014	11/6/2014	2 sites
Urbana	11/16/2012	6/21/2013	5/31/2013	12/12/2013	4 sites	5/5/2014	4 sites	5/5/2014	12/01/2014	2 sites

¹ground was too wet.

Preliminary results:

Important -yet preliminary- results indicate that there exists a substantial amount of nitrate in the field during the fall season in particular following the corn crop each year (**Figure 1**). There are on average about 30 and 18 lbs/acre of nitrates in the top 2 feet of soils from fields coming out of corn production that goes down to about 7 lbs/acre of nitrates within the third feet with no differences between corn and soybean fields at this depth. The following spring and after cover crop growth we observe a decrease in the soil nitrate levels for all treatments including the controls to a range of 10-16 lbs/acre of nitrates (**Figure 2**). Only cereal rye planted after the corn crop generated a statistically significant reduction in nitrate levels.

Regarding cash crop yields, soybean was not affected by cover crop treatment showing yields between 51 and 52 bu/ac on average among locations and years. Corn yielded 180bu/ac on average and it was slightly negatively impacted when grown after clover, rape or ryegrass (**Figure 3**). We do not know the reasons behind this and having more years of research will allow us to have a realistic assessment of the cover crop potential to affect yields and scavenge N.



Harvested Crop effect on Fall Nitrate-N

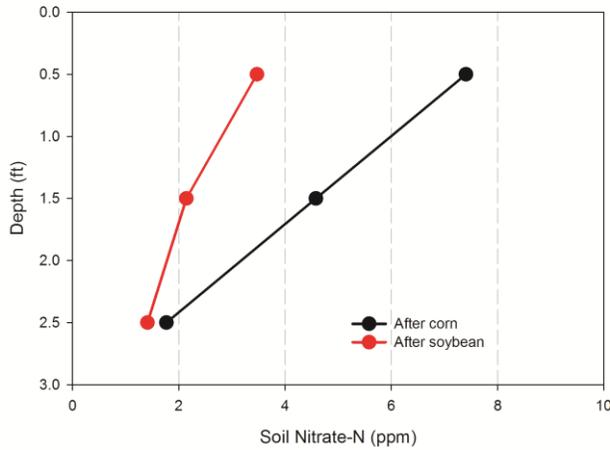


Figure 1. Soil nitrate concentrations during the fall season averaged over two years and four locations.

Cover Crop effect on Spring Soil Nitrate-N

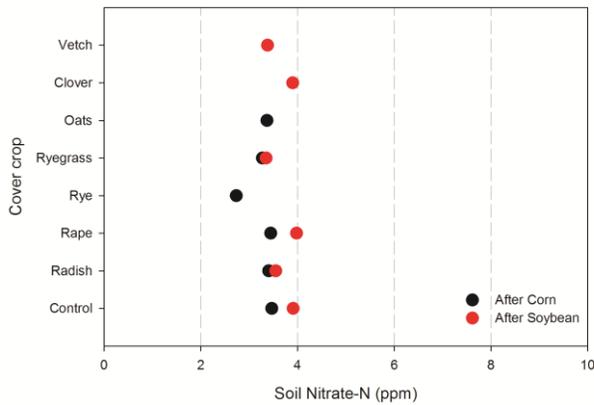


Figure 2. Soil nitrate concentrations during the subsequent spring season averaged across depths and over two years and four locations.

Crop Yields following Cover Crops

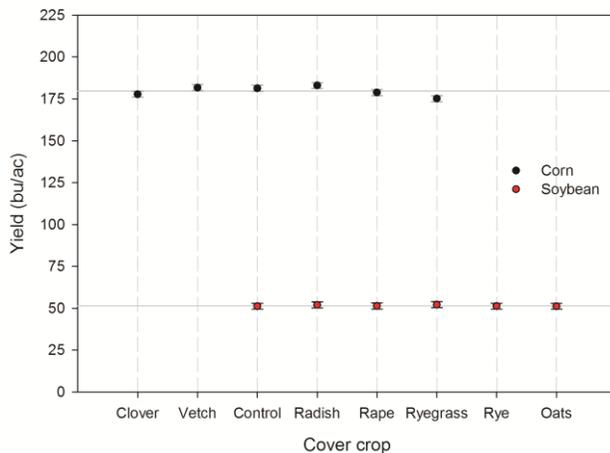


Figure 3. Corn and soybean yields following cover crops averaged over two years and four locations.



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Outreach:

Our collaborator Robert Bellm held the Brownstown Agronomy Research Center Field Day on August 6th, 2014, in which 90 or so participants, primarily crop producers and CCAs attended. NRCS Soil Conservationist utilized soil pit and cover crop plots to talk about soil health, and how it is affected by crop management practices. At the Crop Science Field Day in Urbana on August 14th, 2014, Robert Bellm and Dennis Bowman discussed the NREC cover crop data to date, as well as issues related to cover crop establishment success; about 400 people attended the field day. At the Ewing Demonstration Farm Cover Crop Field Day on November 6th, 2014, around 25 participants, Robert Bellm discussed the advantages and disadvantages of cover crops, management techniques, and establishment challenges; primarily crop producers and some CCAs attended. Robert Bellm also discussed the NREC cover crop data to date, as well as issues related to cover crop establishment success at the Illinois Central College Cover Crop Training and Tour on November 6th, 2014. At the Brownstown Agronomy Research Center Cover Crop Field Day on November 13th, 2014, Robert Bellm utilized soil cores pulled from cover crop trials to discuss claypan soil issues and limitations, as well as cover crop species rooting depths. In addition, tours of the cover crop trial plots were taken and discussion of cover crop species characteristics, establishment, and growth occurred; tours of other cover crop trials showed the effects of seeding date and method. Mr. Ivan Dozier presented his data at the ASA-CSSA-SSSA Annual conference in Long Beach, CA:

- Dozier I, GD Behnke, ED Nafziger, and MB Villamil. Agronomic Assessment of Cover Crops in Illinois. Poster presented at ASA, CSSA and SSSA International Annual Meeting. Long Beach, CA. Nov 2-6.

Dr. Villamil also had the opportunity of sharing results from this project at local and international venues during the fall 2014 period:

- Villamil MB, D Bowman, and ED Nafziger. Cover crops for Illinois: What we hear and what we know. Agronomy Day. Crop Sciences Research and Education Center. Urbana, IL. August 14, 2014.
- Villamil MB. Cultivos de cubierta para producción sustentable. Talk offered to visiting members of the Fundación “Producir Conservando” from Argentina. Aug 19 2014.
- Villamil MB. Cover crops for sustainable cropping systems in IL. Invited speaker. CPSC Fall Seminar Series, University of Illinois. Oct 2. 2014.
- Villamil MB. 2014. Opportunities and challenges in today’s Agro-ecology. Keynote Speaker. New Perspectives on Agro-ecology and Sustainability Symposia. University of San Luis Potosí (USALP), Mexico. Dec 1-4.
- Villamil MB. 2014. Working with cover crops in Illinois. AgMasters Conference. University of Illinois Dec 15-16. <http://www.cropsciconferences.com/program/10> .
- Villamil MB. 2015. Cover Crops in Illinois Row Crop Production: Answers or Just More Questions? Crop Management Conferences. <http://web.extension.illinois.edu/csrec/2013conference/> Offered at 4 venues around Illinois: Champaign, Malta, Mt. Vernon, and Springfield. Jan-Feb 2015.

Budget updates: No changes are required at this time.

NUTRIENT RESEARCH AND EDUCATION COUNCIL
"Agronomic and Environmental Assessment of Cover Crop in Illinois"
Award Period: April 15, 2013 - December 31, 2014
Current Reporting Period: May 1, 2014 - December 31, 2014
INTERIM FINANCIAL REPORT

INVESTIGATOR: Maria Villamil

EXPENDITURES:	PRIOR PERIOD EXPENSES	CURRENT PERIOD EXPENSES	CUMMULATIVE EXPENSES
Salaries & Wages	\$41,799.20	\$39,952.68	\$81,751.88
Fringe Benefits	\$7,192.63	\$7,352.28	\$14,544.91
Material & Supplies	\$40,992.40	\$3,908.93	\$44,901.33
Travel	\$4,425.49	\$2,686.00	\$7,111.49
Contractual Services	\$4,374.79	\$13,447.36	\$17,822.15
Services	\$16,087.55	\$28,434.10	\$44,521.65
 Total Direct	 \$114,872.06	 \$95,781.35	 \$210,653.41
Indirect	\$11,496.39	\$10,197.52	\$21,693.91
Total	<u>\$126,368.45</u>	<u>\$105,978.87</u>	<u>\$232,347.32</u>

AWARD:	
4/15/13-12/31/14	\$376,528.94
Interest Accrued to date	<u>\$6.96</u>
	\$376,535.90
Less Expenditures	<u>\$232,347.32</u>
BALANCE	<u>\$144,188.58</u>

This report was prepared from
financial records of the
UNIVERSITY OF ILLINOIS
GRANTS AND CONTRACTS OFFICE

Sandra Moulton

Sandra Moulton, Senior Director
Post-Award Administration