



Villamil – Nafziger • NREC 2013-03556
Interim Research Report II- 07/01/13 to 12/31/13
Agronomic and Environmental Assessment of Cover Crop in Illinois

Background

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. Our hypothesis is that the use of cover will help retain nutrients in the field and thus prevent their loss to water while increasing nutrient-use efficiency. We also want to test the hypothesis that cover crops can be managed with no loss of main crop yield, and possibly with some increases in main crop yield in some cases.

Our project will make a difference for farmers in Illinois because we will work together both on commercial production fields and at Research and Education Centers to generate relevant and location-specific information that will address the range of soils and practices found among fields and farms. Likewise, performing this experiment on several farmers' fields across the state will allow a realistic assessment of the cover crop's ability to scavenge N at the landscape level.

Project participants:

In addition to the PI Dr. María Villamil and Co-PI Dr. Emerson Nafziger of the Crop Sciences Department of the University of Illinois, the research team includes four Commercial Ag Extension Educators – Robert Bellm, Dennis Bowman, Russ Higgins and Angie Peltier – and Dr. Rachel Cook from Southern Illinois University. Mr. Gevan Behnke works on the project, and MS student Mr. Ivan Dozier joined the project in July 2013.

Objectives: 1) To develop a comprehensive set of trials to look at effects of cover crops in both on-farm and on-station 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 07/01/13 to 12/31/13:

Research Centers:

- **New locations:** In addition to our already established research plots at the Research & Education Centers at DeKalb, Monmouth, Urbana, and Brownstown, Dr. Cook of SIU establish two study sites, one at Dixon Springs REC (University of Illinois Crop Sciences) and the other one at the SIU farm at Carbondale during the fall of 2013.
- **Experimental layout:** The experimental layout at each of the new sites followed the layout used at the other research centers: a split-block design with four replications to evaluate the effects of tillage (2 levels, tilled and no-till, in the spring before cash crop) and winter cover crops (6 levels) on soil and crop variables. Each phase of the corn-soybean rotation will be present each year and the specific cover crops used before and after each crop are listed in Figure 1.



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Cover Crop After Soybean Harvest (Before Corn Planting)														
↓ Good to cross-plant 10 ft on outside ends of each block														
Rep 1	Clover	40-foot cross-alley, planted	None	Rep 3	Spring tillage done before planting.									
	Ryegrass		Canola											
	Canola		Hairy vetch											
	None		Radish							Canola Clover (red or crimson) Hairy vetch None Radish Ryegrass (annual)				
	Radish		Clover											
	Hairy vetch		Ryegrass											
20-ft alley, planted														
Rep 2	Radish		Ryegrass	Rep 4										
	None		Radish											
	Canola		Canola											
	Hairy vetch		Clover											
	Clover		Hairy vetch											
	Ryegrass	None												
↑ Should cross-plant 10 ft of crop here (in each block) to divide tillage treatments														
Cover Crop After Corn Harvest (Before Soybean Planting)														
<-40 ft->														
Rep 1 10 ft	None	40-foot cross-alley, planted	Spring oats	Rep 3	Canola Cereal rye None Radish Canola Ryegrass (annual) Spring oats									
	Cereal rye		Cereal rye											
	Spring oats		None											
	Canola		Radish											
	Radish		Canola											
	Ryegrass		Ryegrass											
Rep 2	Spring oats		Radish	Rep 4										
	None		Ryegrass											
	Radish		Canola											
	Cereal rye		None											
	Canola		Spring oats											
	Ryegrass		Cereal rye											

Figure 1. Experimental layout of research plots at each of 5 Research Centers and at the SIU site.

- **Cover crops** were hand seeded at the rates recommended by the Midwest Cover Crop Council (<http://www.mccc.msu.edu/>) for Illinois during the second week of Sept at all 6 research centers. Rye was seeded at 90 lb/acre, spring oats at 60 lb/acre, clover and vetch both at 20 lb/acre, ryegrass at 15 lb/acre, radish at 8 bs/acre, and canola at 5 lb/acre. Seeding was done with a hand-held spin spreader. Air temperatures around Illinois reached lows of 25 to 22°F during the 4th week of October effectively terminating cold-sensitive cover crops and ending above-ground growth for winter-hardy cover crops.
- **Soil sampling** was conducted at the 6 research center sites after establishing the cover crop treatments. 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 in the already established sites and for complete soil characterization for the newly established sites in southern Illinois.
- **Corn and soybean harvest** occurred later than usual in most sites late Oct to mid Nov, but yields were not affected by the dry conditions of the growing season. Yields were recorded for each plot at each research site.



Activities to date- Farm sites:

- **Farmer Cooperators:** We have established field-scale trials sites with and without cover crops at 8 sites in Illinois with the help of farmer cooperators. Available farm sites are thus located in the following counties: Dekalb (1), Knox (1), Warren (1), Champaign (2), Piatt (2), Bond (1), and Clinton (1). We will continue recruiting collaborators for next cover crop season.
- **Experimental layout:** The experimental layout at each of the farm sites consists of a strip-block design with four replications to evaluate the effects of winter cover crops (control no cover vs cover crop of choice) on soil and crop variables (Figure 2). Producers were allowed to select the cover crop from the list of covers used at the research sites and also to start the project on a corn field or a soybean field.

Possible layout for on-farm (farmer fields) cover crop trials				
	<-----direction of flight and of crop rows----->			
PLOT	Strip of cover crop 40 ft or so wide at the edge of field			
1	30 ft x 400 ft		Cover crop	Rep 1
2	30 ft x 400 ft		Control	
3	30 ft x 400 ft		Control	Rep 2
4	43 ft x 400 ft		Cover crop	
5	43 ft x 400 ft		Cover crop	Rep 3
6	34 ft x 400 ft		Control	
7	34 ft x 400 ft		Control	Rep 4
8	30 ft x 400 ft		Cover crop	
	Rest of field planted to cover crop.			

Figure 2. Experimental layout at farm sites.

- **Cover crops** were aerial seeded at the rates recommended by the Midwest Cover Crop Council (<http://www.mccc.msu.edu/>) for Illinois during the second half of Sept at all 8 sites.
- **Detailed information** on agronomic management and plot history was collected for each farm site. Plots were geo-referenced to facilitate sampling and re-visiting the plots during the time of the project.



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- **Soil sampling** was conducted at all farm sites after establishing the cover crop treatments. 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 complete soil characterization of these newly established farm sites.

Challenges: The dry soil conditions that prevailed throughout the growing season and into the fall hampered cover crop establishment in some areas and force some producers to opt out from the project due to the late crop harvest. Producers are still interested if conditions improve in future years. Early snow at the southern sites delayed some of the soil sampling.

Outreach:

Cover crops were a topic at the 2013 Brownstown Agronomy Research Center and Northwestern Illinois Agricultural Research and Demonstration Center Field Days. General research-based information and specific information about this NREC-sponsored project were presented to agricultural professionals as part of the field day tour by our Commercial Ag Educators. This tour stop generated considerable audience interest as large cereal rye, annual ryegrass, oilseed radish, canola, spring oats, hairy vetch and crimson clover plants were used as visual aids for each tour group. These sample plants were also used to generate discussion in the University of Illinois College of ACES tent at the 2013 Farm Progress Show.

Many more people were made aware of cover crops in general and this project specifically through radio interviews of Angie Peltier with WIRL in Peoria, WRAM in Monmouth, and WGIL in Galesburg, Illinois. Cover crops were featured as a timely topic in a blog article and through the Unit 7 Extension Newsletter that reaches citizens in Henry/Mercer/Rock Island/Stark Counties.

In addition, Cover Crop and Nutrient Recycling presentations were made in Elizabeth in Jo Daviess County and as part of the Soil Health seminars where Russ Higgins partnered with NRCS, Illinois Department of Agriculture and County Soil and Water Conservation Departments. Presentations reaching over 150 total participants were made at Dwight, Yorkville, Watseka, Streator, St. Charles, and Bloomington. Russ Higgins also participated in radio interviews with WSPY in Plano, WLBK in DeKalb, WCSJ in Morris and WOAM in Peoria. Cover crops were featured as a blog articles in the North 160 Acre Blog.

Dennis Bowman was invited to be a member of the Champaign County Cover Crop Committee coordinated by the Champaign County Soil and Water District. Two cover crop field days were sponsored and conducted by this committee in 2013, one in summer and another on November 19th. Dennis used blog entries, news columns and media contacts to disseminate information about cover crops in general and this project in particular. He made a major television appearance occurred during the Farm Progress Show on WCIA.

Budget updates: No changes are required at this time.