

## South Dakota 2018 State Report for Midwest Cover Crop Council

Various projects pertaining to cover crops are in place within South Dakota. Projects range from cover crop establishment in corn and soybean rotations, to nutrient cycling for various cash crops, to herbicide carryover and cover crop implementation. Below are brief summaries related to some, but not all, of the projects taking place in South Dakota.

### **Cover Crop Nutrient Cycling in South Dakota.** **Anthony Bly; SDSU Extension**

Cover Crop use is steadily becoming a field practice on South Dakota croplands. The many reasons for using a cover crop include forage for livestock, wildlife habitat, capture of inorganic nutrients that might harm the environment, and building of soil health through additions of carbon and formation of beneficial soil structure and aggregates. A popular question from agriculture producers is how do cover crops affect the cycling of soil nutrients and how does this influence the growth and yield of cash crops?

A three-year project evaluating the nutrient cycling in the soil began in the fall of 2017 on 30 farm fields across South Dakota. The On-Farm sites encompass the evaluations of three project objectives that are 1. Determine the influence of cover crop composition on nutrient cycling and availability for subsequent cash crops. 2. How cover crop compositions and rate of nutrient loss effect on following cash crop nutrient uptake and yield as well as soil moisture status in western SD. 3. How cover crop carbon/nitrogen ratio effect corn and sorghum nitrogen requirements.

Many cover crop residue and soil samples were obtained from the plots during the fall of 2017 and spring of 2018. Nitrogen rates applied for corn during the spring of 2018 and corn plots monitored for response to nitrogen. Currently, the corn plots are drying down and harvest will be soon. Another set of cover crop plots for 2019 have and continually established throughout the fall. Soil moisture monitoring was expanded at the request of the funding organizing and probe installation is currently underway at three locations across South Dakota.

Justin Brown, MS graduate student, started working with Chris Graham during the summer of 2018.

Dr. Debankur Sanyal started in his position as project coordinator on September 10, 2018. Debankur will primarily be responsible for project sample collection, processing, analysis and data management. John Wolthuizen (undergraduate student) assisted with project sample collection and processing in 2018.

**Funding:** USDA/NRCS South Dakota

**Principle Investigator:** Anthony Bly

**Co-Investigators:** David Karki, Sara Bauder, Ruth Beck, Chris Graham, Howard Woodard, Peter Sexton, Shannon Osborn, Michael Lehman and Jason Miller

**Student Investigator:** Justin Brown

**Expected Completion:** December 2020 (project extension anticipated)

### **Current Cover Crop Research**

#### **Dr. David Clay; SDSU Department of Agronomy, Horticulture, and Plant Science**

1. Interseeding into corn
  - a. 3 strips each of the following species were drill-interseeded into V7 corn on Jun 20 in NE corner of SD near Claire City
    - i. Winter Rye 35 lbs
    - ii. Radish 7.8 lbs
    - iii. Mix of Berseem clover 1 lb, Crimson Clover 1.4 lb, Turnip .3 lb, Radish .7 lb, Winfred Brassica .4 lb, Forage Collards .3 lb.
  - b. NRCS checked up on it and saw nice growth in all treatments. Unfortunately, by time I made it up in early-Sept. to collect biomass, everything was dead, except for an occasional crimson clover. Corn was extremely tall. Probably too much time under dense shade. A lot more work is needed, but it coincides with what we've been seeing for years of interseeding into soybeans.
    - i. Is an earlier drill-interseeding (V4ish) needed to give cover crop more time to establish and tolerate the stress induced by shading.
    - ii. Are corn or soybean varieties that allow more light to pass-through canopy better for cover crop (and unfortunately weed) survival?
    - iii. For now, it looks like safest interseeding option is still flying on in late-Aug/early-Sept. as long as you get sufficient rain
2. After-harvest seeding (since we've been failing at interseeding)
  - a. Winter rye and field pennycress (separately) drilled in Fall 2018
  - b. Going to look at different termination timings this Spring (possibly let grow with corn up to V2) to see how they impact corn yields.
    - i. Can Spring moisture uptake be increased to possibly help promote no-till on wetter soils?
  - c. Aurora Research Farm (Oct. 4) after silage harvest
    - i. Rye came up but pennycress did not – suspected that rye was seeded deeper (0.75-1”), and therefore, into moisture
    - ii. Pennycress had tiny seeds and therefore, needed to be seeded shallow (1/4-1/2”), so sat in dry soil all Fall, so never saw any emerge
  - d. Drilled after soybean harvest in farmer's field on Oct. 30 near Beresford in SE SD
    - i. Cold Nov, rye or pennycress did not emerge

### **Impact of integrated crop-livestock system on soil health, greenhouse gas emission, and water quality**

#### **Dr. Sandeep Kumar; SDSU Department of Agronomy, Horticulture, and Plant Science**

Integrated crop-livestock systems (ICLS) enhances ecological interactions among land use systems that improve the efficiency of agricultural ecosystems in nutrient cycling, preserving natural resources, reducing greenhouse gas emission, improving water quality and enhancing soil health. Our USDA-CAP project focusses on assessing the impacts of ICLS on soils and water quality. Livestock and cover crops (CC), when introduced into cropping systems, manure from livestock improve nutrient cycling and crop residues from CC provide feed to livestock and capture nutrients from the livestock waste. We investigated the impacts of ICLS on soil biochemical properties, microbial community structure, greenhouse gas emission and water quality. The results showed that ICLS treatments had a higher soil biochemical properties and microbial community structure. Soil biological activity varied with the treatment and significantly higher

soil microbial community structure was observed under cover crops with grazing (ICLS). Results of greenhouse gas emissions showed that cumulative CO<sub>2</sub> fluxes were reduced by grass dominated cover crops compared to legume dominated. Similar trend was observed in N<sub>2</sub>O fluxes. This study provides a clear link between cover crops, grazing, soil microbial communities, soil health, greenhouse gas emission, and water quality. This may pave the way for better management of the soil biodiversity (soil microbiome) to enhance sustainable soil environment through incorporating cover crops and grazing (ICLS) in the cropping system.

### **South Dakota Farmers: Usage and Determinants of Conservation Best Management Practices Dr. Jessica Ulrich-Schad; SDSU Department of Sociology and Rural Studies**

Dr. Jessica Ulrich-Schad used crop production history to determine 34 counties in eastern South Dakota that had large amounts of corn planted in 2016. A producer survey was distributed to 3,000 producers in these 34 counties, and Dr. Schad received 708 responses. The survey identified whether or not producers were using cover crops, conservation tillage, and/or diverse crop rotations (3+ crops). Further, the survey identified forms of motivation when people adopted conservation practices on their operations (i.e. sense of responsibility to the land, economics, environmental reasons, etc.). Preliminary results indicate that approximately 40% of the respondents are using cover crops in their operations. Motivators for using conservation practices are strongly related to respondents' sense of place/responsibility to their farm, family, and community. Below are a list of papers working their way through publication using information gathered from the survey. This project supports one Ph.D student, at least one MS student, and one undergraduate researcher.

Tong Wang: "Duration of Usage and Farmer Perceptions of the Economic Benefits of Conservation Tillage", Soil Health Institute Annual Meeting, JSWC

Deepthi Kolady: "Adoption of diverse crop rotation: Drivers and implications", Southern Agricultural Economics Association Annual Meeting, Journal TBD

Abdelrahim Abulbasher: "Entrepreneurial Aspirations of South Dakota Commodity Crop Producers", SRSRS, SD Water Conf., Journal TBD

Jessica Schad: "South Dakota Farmers' Sense of Place and Conservation Ethic: Do they matter in farm management?", IASNR Annual Meeting\*

### **HERBICIDE RESIDUAL EFFECTS ON COVER CROPS AFTER CORN SILAGE AND WHEAT Gared Shaffer; SDSU Extension Service**

Interest in cover crops among South Dakota crop growers has increased in recent years. Producers have realized the need for scientific information on residual effects of commonly used herbicides on cover crops for proper incorporation of these species into their cropping systems. Therefore, it is imperative that information about herbicide residuals effects on cover crops is investigated in South Dakota. Surrounding states that include Minnesota, Iowa, Nebraska and Wisconsin have researched this topic to give their producers educational opportunities in learning how to integrate cover crops into their operations (Bosak 2014; Hartzler, B. and others 2015; Stahl 2016; Jhala and others 2016). This research will assist producers and consultants to continue making wise and informed decisions in common South Dakota cropping systems.

Seven research sites have been established for the 2018 growing season. Four wheat stubble plots have been sprayed and drilled with cover crops. Three corn silage plot locations have been established with

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herbicide treatments and cover crops. Data collection will be accomplished this fall. The primary goal of this portion of the project is to increase grower knowledge of herbicide residuals from common herbicide programs used in silage corn and to help growers fine-tune their herbicide program. The research plots may be utilized for late season grower and professional agronomist tours and training events.

**Funding**

South Dakota National Research Conservation Service (NRCS)

**Principle Investigator**

Gared Shaffer

**Co-Investigators**

David Karki, Anthony Bly, Sara Bauder, Ruth Beck, and Paul Johnson

**Student Investigator**

Sarah Potthoff

**Expected Completion**

December 2020