Building Knowledge about Wisconsin's Cover Crops

FARMER RESEARCH PROJECT - 2020

CCROP Cover Crops Research and Outreach Project

We're excited to share results from a farmer-researcher collaboration initiated in 2020 to expand knowledge about cover crop use in Wisconsin. CCROP is a team of researchers and outreach specialists working with farmers to improve water quality and soil health through cover crops and other regenerative farming practices.

Based on previous survey work it is clear that farmers in Wisconsin need more geographically specific information about the performance, challenges, and benefits of cover crops. With the help of farmers from around the state willing to share their cover cropping practices and experiences, this citizen science effort intends to address that need. We're also aiming to improve cover crop estimates in models like SnapPlus, and to support farmers in communicating their experiences and practical knowledge with others.

We conducted an on-line survey asking farmers about cover crop practices on one of their fields, which ranged from 5 to 135 acres. Along with questions about previous cover cropping experience, we asked farmers to describe crop rotations, fertility and tillage treatments, yield, and costs. Participants also provided images of crop growth, with a subset allowing us to collect biomass samples at the end of the growing season.

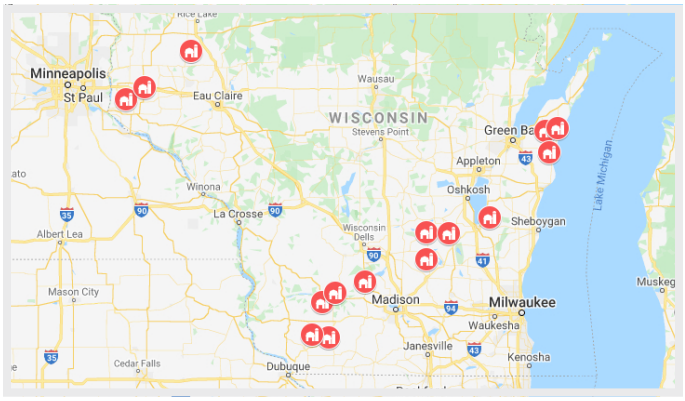

Figure 1. The locations of participating farmer researchers augmented CCROP's database with information from areas of the state where cover crop data is lacking.

Figure 2. Planting corn "green" into winter rye cover crop in south-central Wisconsin, May, 2020

Results

Cover cropping experience and species selection: A total of 15 farmers participated in 2020, with about half of them reporting from areas lacking cover crop data. Experience with cover crops ranged from 1 to over 10 years, with the largest group (5 growers) reporting that they had 4-6 years' experience (Figure 3).

Winter wheat was the most common previous crop in our survey, accounting for 40% of fields (Figure 4). The second most common previous crops were corn for grain and silage, each representing 20%. Green bean, peas, and soybeans were each listed as previous crops by 3 respondents.

Ten out of the fifteen producers planted a multi-species cover crop mix containing anywhere from 2 to 6 species. Annual ryegrass, oats, radish, and various clovers were common components in mixes (see data table). For producers planting single species, annual ryegrass and cereal grains (rye, wheat, triticale) were the most common cover crops. Volunteer winter wheat was noted as a common

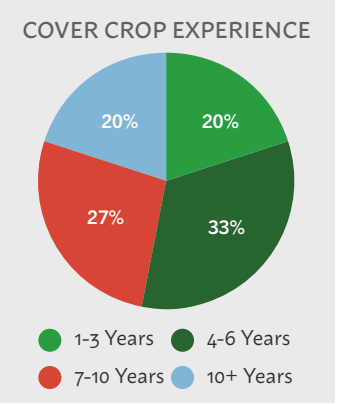

Figure 3. Experience with cover cropping ranged from 1 to 10+ years among participating farmers.

volunteer in cover crop fields established following winter wheat harvest. Asked how they selected their chosen species of cover crop(s), the largest group (9 respondents, all of whom had 7+ years of working with cover crops) chose "personal experience." "Agronomist," "seed dealer," and "farmer-led network" were identified by 2 respondents each as primary information sources.

Fertility and planting practices: Almost all respondents maintained optimum soil fertility levels based upon University of Wisconsin-Madison Extension recommendations. The research fields surveyed were primarily classified as fine textured silt loam soils. Manure was applied on 47% of respondents' fields, with 4 out of 15 fields receiving a manure application prior to cover crop establishment and 5 out of 15 fields receiving a manure application after cover crop establishment. Two fields received manure before and after cover crop establishment. Liquid manure was used across the board, with application rates ranging from 10,000-15,000 gallons per acre.

Over half (67%) of farmers reported using tillage on their fields prior to cover crop seeding (Figure 5). No-till methods were used on 33% of the fields. The primary planting method reported was via grain drill (80% of fields).

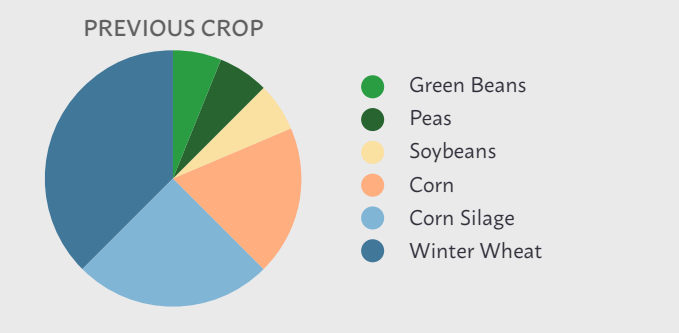

Figure 4. Winter wheat was the most commonly identified previous crop in our survey, accounting for 40% of fields, followed by corn for grain and silage.

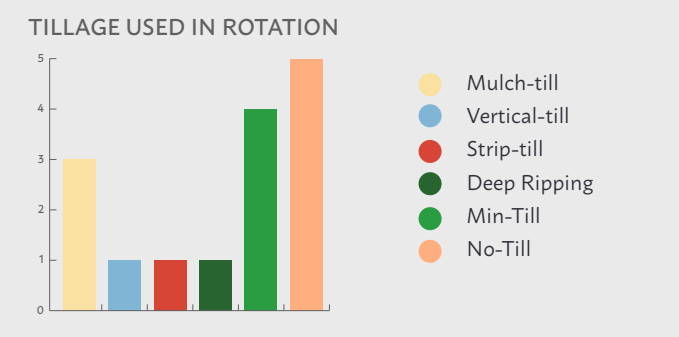

Figure 5. The majority of farmers tilled fields prior to cover crop seeding (67%). No-till methods were used on 33% of the fields.

Discussion

Small grains like winter wheat provide one of the best opportunities for cover crop establishment in WI cropping systems. Our survey results bore this out in both reported practices and total biomass production. Cover crop biomass production in this survey ranged from a low of 0.1-ton DM/ac with 453 GDUs (Base 40F) to a high of 3.2 with 2178 GDU (Figure 6). Canning crops, like peas and beans, provide a window that is as good as small grains, if not better. While corn silage also provides a decent planting window, and one that is better than following soybeans or corn, it is less optimal than following small grains or canning crops.

The 2020 growing season provided excellent opportunities for cover crop establishment, including timely rainfall, good fall harvest conditions and above normal fall temperatures. Estimates of cover crop biomass production obtained from this study are consistent with the long term (30+ years) Wisconsin Cover Crop Database. This large data set shows that dedicating an entire fallow season to cover crop growth and development is likely to yield the most overall biomass (0.6 to 3.7 ton DM/ac). After this option, the most successful windows include following winter wheat (0.4 to 2.8 ton DM/ac), and corn silage (2.2 ton DM/ac). Drilling after soybeans or corn were the least successful options (~0.5 ton DM/ac) though inter-seeding and removing corn stover can improve cover crop success (~1.5 ton DM/ac). Note: The range in estimates above is due to differences in cover crop species.

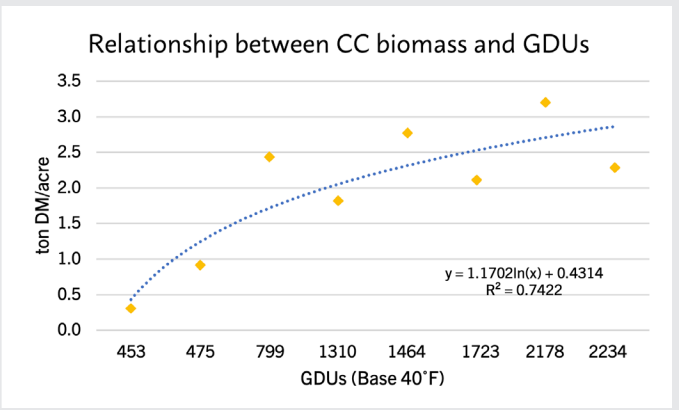

Figure 6. Relationship between cover crop biomass and growing degree units. Cover crop biomass production in this survey ranged from a low of 0.1 ton DM/ac with 453 GDUs (Base 40F) to a high of 3.2 with 2178 GDU. The success of a planting window or the total biomass a cover crop will produce is strongly related to the growing degree units. The more days a cover crop is in the field the more it can do for you. Precipitation and soils also play a role but the longer the growing season, the more successful a cover crop planting will be.

CCROP Citizen Science Data 2020

			Planting			CC Biomass				
County	**Previous Crop**	**CC Species**	**Rate (lb/ac)**	**Method**	**Date**	**Harvested**	**Ton (DM/ac)**	**StdErr**	**GDU[1]**	**Spring CC Termination**
Iowa	Corn Grain	annual ryegrass	70	drill	9/26/2020		—	—	—	early
Kewaunee		annual ryegrass, crimson clover, oats, red clover	22	drill	7/5/2020		—	—	—	plant green
Iowa		crimson clover, hairy vetch, oats, radish, rapeseed	62	drill	9/22/2020	11/3/2020	0.1	0.0	453	early
Iowa	Corn Silage	cereal rye	110	drill	9/22/2020	11/3/2020	0.5	0.1	453	harvest for forage
Kewaunee		triticale	140	drill	9/21/2020		—	—	—	harvest for forage
St. Croix		winter wheat	90	aerial	9/20/2020	11/6/2020	0.9	0.4	475	plant green
Green Lake	Green Beans	radish, winter wheat	2.5 (radish) 55 (wheat)	drill	9/1/2020	11/2/2020	2.4	0.2	799	early
Sauk	Peas	annual ryegrass, berseem clover, crimson clover, oats, radish, red clover	50	planter (15 inch)	7/18/2020	11/2/2020	3.2	0.5	2178	fall frost
Lafayette	Soy-beans	annual ryegrass, radish	5 (radish) 56 (rye)	aerial	8/30/2020		—	—	—	early
Barron	Winter Wheat	annual ryegrass, berseem clover, crimson clover, red clover, dwarf essex rape	20	drill	8/15/2020	11/6/2020	2.8	0.1	1464	plant green
Kewaunee		cereal rye	120	drill	9/27/2020		—	—	—	plant green
Fond du Lac		cereal rye, oats	100	drill	7/20/2020	11/2/2020	2.3	0.2	2234	early
Dodge		crimson clover, radish, winter wheat	11	Brillion	7/31/2020		—	—	—	plant green
Pierce		radish, red clover	5	drill	7/31/2020	11/6/2020	1.8	0.2	1310	plant green
Fond du Lac		peas, oats, radish, sunflower, red clover	85	drill	7/31/2020	11/13/2020	2.1	0.1	1723	early

[1] *Growing Degree Units (Base 40˚ F)*

Participant Feedback: Farmer participants provided valuable thoughts and feedback on project design as well as lingering questions. Among these questions, farmers asked:

- How can I apply liquid manure and establish a cover crop following corn silage?
- Are there inexpensive and practical ways to measure progress on soil health?
- Where can I learn more about multi-species cover cropping mixes?
- Can I reduce my fertilizer rates following a cover crop?
- When planting "green", can I wait until corn emerges before terminating my rye cover crop?

One respondent commented on the heavy rains following cover crop planting in 2020, noting that, in the context of extreme weather, crop reporting with FSA and RMA could be more flexible about the timing of decisions around planting green or harvesting cover crop seed.

This feedback is critical as we plan next steps for cover crop research and outreach. Farmers can also find useful information on soil health and cover crops among UW's Nutrient and Pest Management program many publications, including:

- *Legume nitrogen credits:* Nutrient Management Fast Facts
- *Herbicides and cover crops:* Herbicide Rotation Restrictions for Cover and Forage Cropping Systems
- *Cover Crop Species:* Cover Crop Selection Card for Northern Wisconsin & Cover Crop Selection Card for Southern Wisconsin

Next Steps

We are gearing up to continue this work in 2021! If you are interested in participating in our group of farmer researchers, and receiving support to do so, or if you have general feedback on cover cropping in Wisconsin, email Dan Smith at dhsmith@wisc.edu, or call 608-219-5170. You can also sign up here if you are a new participant.

Report authors include Mrill Ingram, Gregg Sanford, and Dan Smith. Layout and design by Daniella Echeverria. Visit our website to learn more about CCROP.

In addition to the sponsors below we are grateful for support from Wisconsin USDA's Natural Resource Conservation Service.

Figure 7. Planting winter rye using a no-till drill in southwestern Wisconsin, November 2020

Michael Fields Agricultural Institute

NPM Nutrient and Pest Management Program

CIAS Center for Integrated Agricultural Systems

USDA Dairy Forage Research Center

Thank you to all the participants

USDA United States Department of Agriculture
Natural Resources Conservation Service