PROJECT TITLE: Soil Health Partnership Expansion in Minnesota

PROJECT NUMBER: 6030-20DD

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ABSTRACT

The goal of this project was to launch and fully support a comprehensive SHP program in Minnesota. This project is part of the larger NCGA SHP network that extends across more than 200 sites in 16 states. This includes on farm engagement such as our strip trial research sites, data analysis including peer reviewed literature, and communications efforts across many virtual and in person channels. Our efforts during this project included data collection on 9 farms in Minnesota and extensive farmer engagement activities. We also completed data analysis and have provided a number of reports for academic, policy, and farmer audiences. Key findings of outcomes of our program include increases in soil health metrics through adoption of cover crops, data processing protocols, importance of goal setting as demonstrated by economic case studies, and trends for cover crop impacts on planting dates, weed suppression, and yield.

INTRODUCTION

When soil health first surfaced as a concept in the early 2000s, there was no representation by commodity farmers. This concept was confined to niche markets and university research plots. Consumers, policy makers, and environmental groups began looking to our industry to ask, ‘what are you doing for soil health?’, and at the same time farmers were asking ‘how can I keep improving my soil? What are the next steps I should take on my farm?’

SHP was formed to answer these questions and accurately represent farmers through sound science in conversations regarding the future and sustainability of agriculture. Universities and USDA laboratories had already been evaluating soil health properties for decades. Our goal was specifically to tie these metrics to the complexity of on-farm decision-making to ensure that farm decision tools, policies, and markets were based in a sound understanding of how soil health principles are implemented on production scale farms.

OBJECTIVE AND GOAL STATEMENTS

Initial goals of this project included enrolling 4 on farm trails into our network along with farmer outreach to share what we learned on those farms.

MATERIALS AND METHODS

There were four strip trial sites the MCGA funded.

There were 8 total strip trial sites in MN from 2015 through 2021.

1. The first site established in 2015 was located in south west MN compared a no-till corn soy rotation with and without cover crops.
2. This site was a central MN farm, which was comparing conventional tillage to no-till in a corn, soy rotation.
3. Another central MN farm was comparing cover crops and no cover crops on a corn, soy, sugar beet rotation.
4. This grower was located in south central MN and compared conventional practices to two treatments, no till, and no-till with cover crops in a corn soy rotation.
5. A South-central farmer was comparing cover crops to non- cover cropped ground in a corn soy rotation. He was particularly interested in multi-way mixes, and unique ways to apply them.
6. The northernmost site was a cover crop vs no cover crop trial on new ground, with a corn, soy, and wheat rotation.
7. The second northernmost site was a manure vs. commercial fertilizer, and they wanted to see what impacts to soil health manure could provide in corn soy and potentially wheat rotation.
8. The eastern most site was the last grower to be signed up, and he was interested in comparing a no till and cover crop system to conventionally managed system in a corn soy rotation.

Additionally, SHP signed up one side by side site, which looked at a single specie cover crop mix and a diversified mix in a potato and pea rotation.

Each site's data was consistently sampled, surveyed and collected, while special attention was given to any differences brought on by their specific treatment.

There were four major surveys deployed in 2020, the first being cover crop and post-harvest, then pre-plant and at plant, in season applications, and then fall management. These surveys worked to cover all applications and timings of major management on our SHP trials. These surveys were deployed through Survey123, and ArcGIS application. Surveys were then sent to growers and tracked for progress.

Soil sampling was conducted in 2019 and in 2021 but skipped in 2020 due to Covid-19 restrictions with Cornell shutting down. Ward Laboratories routine nutrient samples from 0-2 and 2-6 inches were collected multiple times within a strip. Cornell soil health tests were collected from 0-6 inches and collected over an entire strip. Samples were then shipped to their appropriate labs and analyzed. Results were then returned to the growers when data was available.

Field checks were implemented in 2020 and performed on the sites that had true treatments ongoing in the field. Trials with no treatments being implemented were ignored. This included most of the new sites as they had not yet implemented their trials. There were four major timings of field checks, the first was post fall cover crop or tillage implementation. The

second was pre planting, the third was early in the growing season, and the last was during crop maturation. The goal of each field check was focused on impacts of the treatment trial on the soil, commodity crop, and water infiltration of the field.

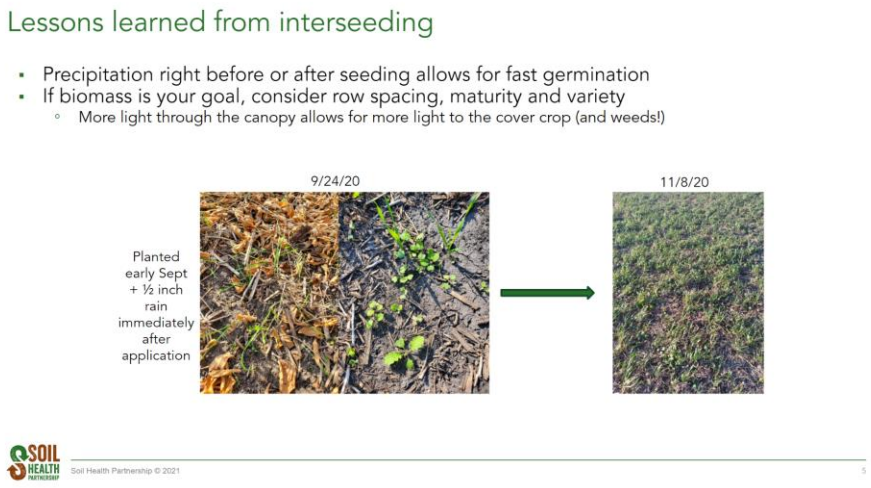
Yield data collected was collected soon after harvest, and was collected in person 2018-2019, while some data was collected virtually in 2020.

RESULTS AND DISCUSSION

Starting in 2018, we have collected on-farm research data on 10 sites in Minnesota including thousands of data points. In the state of MN, required data was collected at least 95% of the time when possible. Growers were enthusiastic to participate in the data collection process.

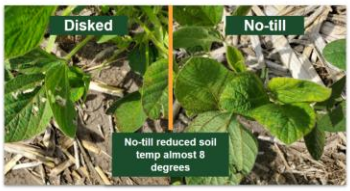
We were able to use our growers' participation to produce many educational resources, and business cases relevant to MN while we built up our more complete data set. This included:

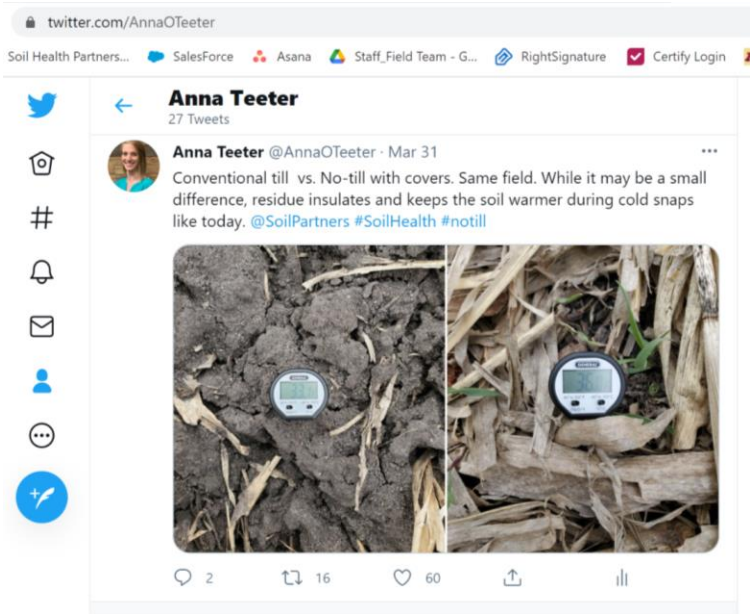
- Farm finance report https://www.soilhealthpartnership.org/farmfinance/achieving-profitability-with-on-farm-conservation/
- Field insights:



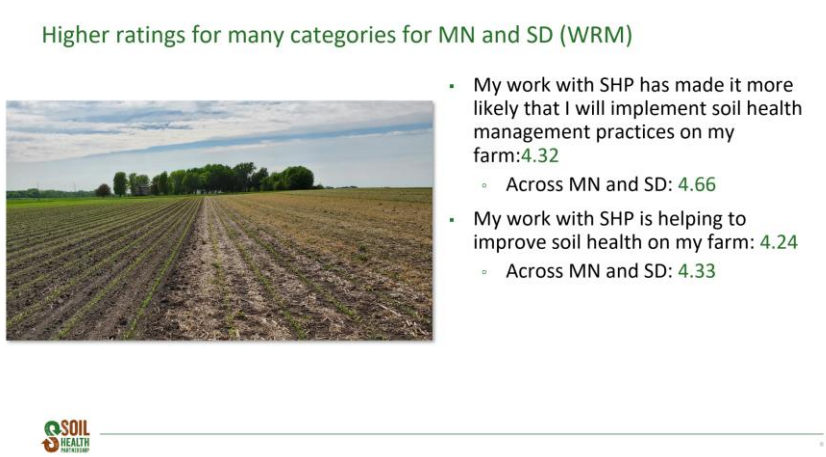
Field observation – soil temperatures

- There was less of an impact on soil temperature in the early spring
- Differences were more dramatic between treatment strips and control in hotter conditions
- Conservation practices such as reduced tillage and cover crops protect the soil from extreme heat





- Farm Feedback and Social Survey results



- Farmer Highlights
  - https://www.soilhealthpartnership.org/farmers/
  - https://www.soilhealthpartnership.org/business-case/increasing-profitability-through-decreasing-tillage/
  - https://www.soilhealthpartnership.org/farmers/trinity-creek-ranch/

With our complete dataset we were able to release a number of very important data collections including:

- Soil metrics outcomes - Nature Food journal https://www.soilhealthpartnership.org/blog-story/tnc-and-shp-scientists-show-soil-health-indicators-increase-due-to-cover-crops/
- Cover crop report https://www.soilhealthpartnership.org/wp-content/uploads/2020/08/SHP-cover-crop-survey-results-2020.pdf
- Winter research meetings (1/28/2021) and (1/28/2020) https://www.youtube.com/watch?v=piTAgNOeJTA

- (Recorded MN meeting was sent to Maciej Kazula and will not be attached here to maintain grower privacy).

CONCLUSIONS

Increasing soil health through farm management works on production scale farms and works particularly quickly on active carbon (Wood and Bowman, 2021).

Keys to achieving soil health outcomes include creating farm specific goals and adapting management standards to regional conditions. Additionally, cost inputs into soil health systems are lessened after 5 years of practice. Brian Ryberg was able to increase profits by reducing tillage which reduced the number of hours and passes on his equipment, reduces fuel usage. Please refer to the farm finance report mentioned above.

Observational conclusions include cc affecting soil temperature, reduced tillage affecting water infiltration and soil tilth, and reducing weed pressure. There is not enough collected data to give statistical significance to these observations.

Overall, many benefits can be seen by implementing soil health practices, and what may be impacted is affected by what goals a particular grower may have.

EDUCATION, OUTREACH, AND PUBLICATIONS

We have held 4 farmer events and engaged over 200 farmers in person prior to 2020. Online content has reached thousands and will continue to reach people. Additionally, content produced in Minnesota or for Minnesota Growers includes:

- Webinars
- “Wheat week”
- Jon stevens field day
- Trinity Creek Ranch field day
- MCGA article
- Podcast for Minnesota Soil Health Coalition
- Work with Minnesota office of Soil Health
- Winter Research meetings
- Soil Health Summit

SHP also participated in events to share information specifically about soil health in Minnesota. These included: MN Ag Expo, Midwest Soil Health Summit, Commodity Classic, and many other MN based events.

SHP was also a leader in the advancement of on farm soil health by participating in the NRCS MN State Technical Advisory Committee, Soil Health Leadership Lab, and Field to Market metrics committee.

CITATIONS

Wood, S. A., & Bowman, M. (2021). Large-scale farmer-led experiment demonstrates positive impact of cover crops on multiple soil health indicators. *Nature Food*, *2*(2), 97-103.

Financial Summary

Of the grant funding from grant 6030-20DD, $109,354.90 had been utilized for the period of April 1st, 2020 through December 31st, 2020. For the period of January 1st, 2020 through March 31st, 2021, $10,645.10 has been utilized. The final quarter's expenses will be invoiced through the National Corn Growers Association for the SHP program shortly. These expenses include:

- Personnel & Fringe Benefits - $5,000 – Field Manager support for the work on the sites in Minnesota
- Data Collection Tools & Supplies - $645.10 - supplies for the soil sampling season
- Cooperator Payments - $5,000 - part of the cooperator payments for the research year