

Community College Alliance for Agriculture Advancement (C2A3): Regionally-Specific and Collaborative Educational Approaches to Promote Sustainable Soil Health Practices

Final report for LNC18-403

Project Type: Research and Education

Funds awarded in 2018: \$200,000.00

Projected End Date: 10/31/2022

Grant Recipient: Northcentral Technical College

Region: North Central

State: Wisconsin

Project Coordinator:

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Northcentral Technical College

Project Information

Summary:

Explanation of the problem addressed and the solution pursued:

The project's eight participating community/technical colleges are collaborating to advance agriculture and economic resiliency in rural Midwest communities through this grant and an existing partnership called Community College Alliance for Agriculture Advancement (C2A3). Project participants from 7 states include: Central Lakes College (MN), Clark State Community College (OH), Illinois Central College (IL), Northcentral Technical College (Lead--WI), North Dakota State College of Science (ND), Northeast Community College (NE), Northeast Iowa Community College (IA), and Richland Community College (IL).

This grant funded project facilitates the development of various soil health topics in preparation for training community/technical college students and regional producers to gain an understanding of sustainable soil health management practices. Community and technical colleges significantly impact the nation's agricultural workforce. These colleges yield over half of all U.S. graduates in higher education and serve as a pipeline for a substantial percentage of future agriculture producers, agribusiness professionals, and agriculture technicians. Community colleges excel at teaching students concrete examples of theoretical concepts, yet many producers fail to adopt practices into their farm management practices.

While there is a growing body of “innovative” farmers driven by taking risks and testing new ideas who are launching new soil health management practices with great success, most farmers (and the general population) are more risk averse, waiting for new ideas to be thoroughly tested before trying them out. There is a great need for tools and assistance to help these more cautious “middle adopters”. This project aims to reduce this disparity by facilitating student and producer exposure to educational materials and demonstrations hosted by regional colleges.

2) The project's research approach (if conducted), educational approach and farmer learning outcomes & 3) succinct statement of research conclusions:

The project's primary goal is to increase current and future producers' knowledge in soil health practices and help them adopt practices that are profitable, environmentally sound, and contribute to quality of life. Member colleges are actively reviewing available content from NRCS and other agencies, organizations, and higher education partners. It is our goal to complement and enhance existing materials and curriculum, building in hands-on learning and supplementary activities. Several methods, educational strategies, and inputs are being used to carry out the project.

Year 1 of the project (9/25/18-10/31/19) has resulted in nearly 250 farmers, 340 agriculture professionals, and over 100 agriculture students participating in workshops, field days, and instruction of new curriculum related to soil health practices.

Year 2/2020 UPDATE: Year 2 of the Project (10/1/2019 – 9/30/2020) engaged 74 farmers, 92 agriculture professionals, and 197 agriculture students through workshops, field days, and instruction of new/enhanced curriculum related to soil health practices. The COVID-19 pandemic had a significant impact on the consortium's Year 2 plans and activities. Classes had to be moved to virtual learning and field days were canceled due to social distancing mandates and college closures. However, consortium members adapted to the virtual realm to provide instruction and increase awareness of soil health practices to both students and producers, thus using the pandemic to jumpstart new ideas for greater and more consistent outreach.

Year 3/2021 UPDATE: Year 3 of the Project (10/1/2020 – 9/30/2021) engaged # farmers, # agriculture professionals, and # agriculture students through workshops, field days, and instruction of new/enhanced curriculum related to soil health practices. The COVID-19 pandemic (and variants), continued to have a significant impact on the consortium's Year 3 plans and activities, including travel and field days (thus our request for a no-cost extension). However, consortium members continued to adapt to the virtual realm (Zoom, conference calls, email, videos) to provide instruction and increase awareness of soil health practices to both students and producers, as well as adapt to safe face-to-face options when possible (e.g., social distancing, masks, clean in/clean out, smaller classroom/lab capacity).

Year 4/2022/Final: The participating C2A3 consortium colleges were pleased to be part of the SARE grant focusing on soil research and outreach activities. Partly because of the impact of the COVID-19 impact, the implementation of the grant was not without its challenges, but the activities that did take place, the research data that was collected and the curriculum that are now available to be shared represent a

positive outcome from C2A3's perspective. Agriculture faculty and staff expanded their knowledge about sustainable soil health practices. In turn, they developed curriculum and disseminated information about soil health best management practices to producers and students.

- **Advisory Panels:** Year 1: All eight participating colleges established advisory panels composed of Team Leads, producers, agricultural students, and Extension contacts; identified an advisory panel chair; and hosted at least one advisory panel meeting. The advisory panel members provide advisement on curriculum development, development and dissemination of educational materials, and advisement on implementing outreach activities to promote 2nd/3rd Year producer workshops and field/demonstration days.

Year 2/2020 UPDATE: Central Lakes College: Added a Byron seed representative to the Advisory Committee; the company is willing to assist with seed costs in hopes of learning the agronomic adaptability of different cover crops (i.e., herbicide response/residual effect). Clark State Community College: Met on April 3, 2020 via virtual medium; a presentation was sent out with requests for feedback on project activities. Illinois Central College: The Advisory Council did not meet due to COVID. North Dakota State College of Science: The Advisory Panel met on March 11, 2020; no additional Advisory Panel meetings were held due to COVID-19. Northcentral Technical College: The Advisory Committee did not meet as scheduled in person during March 2020 due to the College closing in response to the pandemic; the Advisory Committee met virtually on October 15, 2020. Northeast Community College: The Advisory Panel met in February 2020, just before the campus closed due to COVID-19 (minutes attached); panel members also met individually with NCC staff to assist with decision making on the research plot. Northeast Iowa Community College: The Agronomy/Crop Science program advisory committee met on September 22, 2020 (agenda attached); the Agriculture Businesses program advisory committee met on September 23, 2020 (agenda attached). Richland Community College: The annual Advisory Panel meeting to be held in April 2020 was cancelled due to COVID.

Year 3/2021 UPDATE: All consortium colleges have participated in SARE and C2A3 Zoom meetings. Central Lakes College: Byron Team meeting, February 23, 2021; Byron Team meeting, August 23, 2021. Clark State Community College: Advisory Committee meeting, November 3, 2020; Advisory Committee meeting, April 6, 2021. Illinois Central College: Met per usual. North Dakota State College of Science: Land Lab Advisory Committee meeting, November 10, 2020; Land Lab Advisory Committee meeting, April 7, 2021; Panel includes Kelly Klosterman (farmer, member), Chris Johnson (farmer, member), Vance Johnson (farmer, member), Brad Toussaint (farmer, member), and Kelly Hubrig (Alumni Foundation Board member, member). Northcentral Technical College: The Committee met virtually in the spring and in the fall due to social distancing requirement due to COVID-19 pandemic. Northeast Community College: The SARE grant advisory panel met on February 11, 2021 which included planning session for grant demonstration efforts at college-sponsored field day set for September 2021; worked out an idea to incorporate the public, local producers, local FFA Chapters, and NCC students at an open house/field day; although not all panel members

were able to make the meeting, the panel members also met individually with NCC staff to assist with decision making on the research plot; contributing their expertise as advisory panel members: Ben Wolken, Wolken Seed Co., chairman; Rob Thomas, now serving as field agronomist for Farmer Pride Cooperative in Battle Creek; Logan McKeon with Wolken Ag Services; Caleb Zohner, producer; Devin Johnson, field agronomist for CHS in Bloomfield. Northeast Iowa Community College: The Agronomy/Crop Science program Advisory Committee met March 23, 2021 and September 22, 2021; the Agriculture Businesses program Advisory Committee met March 24, 2021 and September 23, 2021. Richland Community College: Met per usual.

Year 4/2022/Final: All consortium members met with their Advisory Committees regularly/twice a year and plan to continue to do so after the grant project ends. Members include producers, agronomists, extension agents, agriculture employers, faculty and students. Advisory Committees supported grant activities, provided ideas and feedback, recommended adaptations, advocated for soil health practices, and disseminated information.

- **Annual C2A3 Conference Participation:** Year 1: On September 30, 2018, 34 faculty and staff from all eight participating colleges convened at Richland Community College for the first Project Annual Meeting and Project Kickoff. This meeting was an additional day consecutive to the C2A3's two-day annual professional development conference for faculty. At this first meeting, NTC provided an overview of the grant, discussed project timeline and deliverables, distributed a project manual, explained the grant monitoring and communication processes, and discussed curriculum plans. Each college defined and narrowed down their project focus and activity, then determined what help instructors may need. The colleges also discussed partnering based on sub-topics. Project attendees were invited to stay for the C2A3 Annual Conference and were provided professional development opportunities (see attached agenda). The conference was also attended by Jimmy Bramblett, Deputy Chief for Programs, USDA NRCS; Dr. Beth Nelson, Regional Coordinator, Northcentral SARE; and other State NRCS representatives.

Year 1: On September 29, 2019, 49 faculty and staff from all eight participating colleges convened at Northeast Community College for the second Annual Meeting. The group discussed grant compliance, shared challenges and best practices with producer outreach, facilitated soil health lessons, and reported out on grant project. During the Soil Health Lessons session, each college shared an impactful soil health lesson and provided copies of the lesson plans and any other related materials. After the session each lesson plan was uploaded to the C2A3 SharePoint for colleges to access remotely. Attendees provided positive feedback on this session and found it to be very valuable as the similarities and differences in soil types between the states became more apparent. Project attendees were invited to stay for the C2A3 Annual Conference and were provided professional development opportunities (see attached agenda), including a session presented by Ivy Tech Community College on their 2019 Industrial Needs in Precision Agriculture Regional Survey.

Year 2/2020 UPDATE: Central Lakes College hosted the C2A3 annual conference virtually due to COVID-19; all consortium colleges participated as well as NRCS

state and federal leaders. The 1 ½ day conference agenda is attached with various colleges leading topics. Consortium members discussed how to begin bridging students to work experiences with USDA-NRCS. SARE Project Consortium Calls: Each consortium college member had representation and participation in all scheduled calls. Agenda topics included updates from faculty on curriculum, field days, and collaboration with local NRCS and producers; budget modification requests; work towards Project goals and objectives; COVID-19 updates and adaptations; and other promising practices sharing.

Year 3/2021 UPDATE: C2A3 held its annual conference in-person with virtual attendance options, hosted by Central Lakes College in Minnesota, September 19-21, 2021. During the Advisory Council Visioning Session, participants discussed the SARE project, challenges and successes, best practices for field day participation, and agreed that it would be beneficial to request a one-year no-cost extension in order to have a great impact beyond COVID-related challenges. The agenda also allowed for faculty to participate in tours and have conversations related to the SARE project, instruction, field days, crops, and soil health. Each college had representation at the conference including faculty, deans, presidents, and other staff. Northeast Community College brought two students from their agriculture program who shared their insights to the experience; the other colleges are planning/hoping to bring students to the 2022 conference and the host college will consider a student track in the agenda. All colleges continue to engage in C2A3 quarterly Advisory Committee meetings, grant meetings, and professional development webinars.

Year 4/2022/Final: Annual C2A3 conferences were held. Each college had representatives at the conferences including Presidents, Vice Presidents, Deans, Faculty, some students, and NRCS representatives from each C2A3 member state. Often producers were included either for tours, panels, or attendance. Agendas included review of C2A3 goals, updates, and expansion; faculty showcases of impactful agriculture lesson plans; tours of each college's farm and/or partner farms; presentations by key agriculture representatives (local, state and national); Board meetings; NRCS presentations; and breakout sessions on various topics. Richland Community College (IL) hosted in 2018; Northeast Community College (NE) hosted in 2019; Central Lakes College (MN) hosted virtually in 2020 and in-person in 2021; Clark State Community College (OH) hosted in 2022; and Illinois Central College will host in 2023.

- **Common Thread Curriculum**: The project's approach is to educate producers (farmers/ranchers) and community/technical college students on best practices in soil health by delivering "common thread" curriculum that is relevant across all seven states. All participating colleges have begun exploring and developing soil health curriculum sub-topics and educational materials specific to their area. Through quarterly consortium phone calls, annual in-person consortium meetings, and a web-based collaborative platform (SharePoint), the colleges are working collaboratively to contribute knowledge on topics and share educational materials and curriculum as they are discovered and developed. Each college has purchased and begun to use soil health test buckets with soil quality test kit exercises to help

implement soils curriculum in the field and/or classrooms. Individual college project focus and progress is reported below.

- **Central Lakes College**

- **Project focus:** Soil microbial health: improvement by integrating cover crops into conventional row crop rotations with seasonal livestock grazing. Central Lakes Community College is leading this topic area to provide content such as the benefits to adding cover crops and livestock to row crop rotations through developed and/or identified adaptive practices for producers with coarse, sandy soils under irrigation. The project includes faculty incorporating cover crops into traditional row crops and taking soil measurements to determine soil biological growth and will use information gathered to create curriculum for the project. Additionally, they will take general soil health observations as they relate to livestock grazing behaviors and incorporate into the curriculum for dissemination to the consortium.
- **Year 1 Summary:** Central Lakes College integrated cover crops into most of the designated area (500 acres). As the growing season came to a close they introduced nearly 400 head of cattle to the area for a 30-day period. This livestock integration is a key component to the overall soil health objective of the project. The Haney soil samples were gathered and tested to set a “base” to soil components and health. These soil health observations, as they relate to livestock grazing behaviors will be incorporated into the curriculum for dissemination to the consortium.
- **Year 2/2020 UPDATE:** CLC hired a contractor to assist in developing curriculum and education, but due to COVID-19 the process has been delayed. Plans are underway to purchase and utilize Soil Quality Test Buckets. Challenges: Weather slowed growth of rye and therefore delayed grazing, limiting the number of days cattle could be integrated into the system. We have struggled for cattle to be able to gain weight on a consistent bases while grazing as a part of this Project. Successes: We have been able to successfully establish cover crops for grazing purposes and lengthen the grazing season for our beef producer partners. Inkind donations: 200 acres of rye seeding. Project impact on college/community: We have been able to continue building professional relationships within our communities and gain credibility with farmers. The farming community is developing a stronger interest in using cover crops and grazing together to be better stewards of the land.
- **Year 4/2022/Final:** Posted Natural Resources (directly trains students to become employed by NRCS upon graduation; developed NRCS internships for students) and Grazing curriculum on C2A3 site and shared at C2A3 annual conference 2021.

- **Clark State Community College**

- **Project focus:** Compaction: cover crop trial investigation into capabilities of various cover crops to reduce soil compaction. Water Quality: co-leading this topic area to examine the effects of in-field cover crops and directly

measuring soil erosion from test plots. Weed Suppression: measuring the weed suppression capabilities of various cover crops.

- **Year 1 Summary:** Clark State Community College tilled an area to serve as their research plots and has begun collecting soil samples. In late October, the college seeded cover crops, is scheduling to plant a crop this spring, and will collect some additional soil data. In soil science and crop production courses, the college has begun to incorporate increased emphasis on conservation tillage and soil erosion. Additionally, integration of how various weed control methods relate to soil health and soil erosion have been included in the plant pest course. This semester (Spring 2020), faculty have again put extra emphasis on soil conservation and best practices in the soil fertility course (AGR 1350). New equipment has been incorporated into courses (disk, roto-tiller, slit seeder) and students have reported enjoying the more “hands-on” approach to their courses.
- **Year 2/2020 UPDATE:** CSCC offered AGR 1300 (Soil Science), AGR 2200 (Crop Production), and AGR 2600 (Plant Pests) with 20 students. Soil Quality Test Buckets were used in AGR 1300 and AGR 1350. During Year 2, the Agriculture and Horticulture programs’ curriculum was assessed and analyzed to determine what changes needed to be made and those will be forthcoming. Successes: We were able to hire a student and provide an excellent learning opportunity. It was nice to have demonstration plots for teaching. This year collecting data went well. We are looking forward to seeing how well the cover crops do. We are also hoping to have attendees and a live Field Day this year.
- **Year 3/2021 UPDATE:** During Year 3, significant changes were made to Agriculture/Horticulture programs. Changes made and relevant to this project: majority of AGR students are now required to take AGR 1750 (Precision Agriculture); new courses developed AGR 1150 (Plant Science), AGR 2601 (Weed Science), AGR 2602 (Plant Pathology), AGR 2603 (Plant Insect Pests), and AGR 2751 (Advanced Precision Agriculture). Soil Quality Test Buckets were used in AGR 1300 and AGR 1350. We very much enjoy using the plots in our classrooms and believe that our curriculum changes have strengthened our programs.
- **Year 4/2022/Final:** The Ag program was overhauled between 2020 and 2021 with new courses created and updated curriculum; this included more focus on conservation practices and soil health.
- **Illinois Central College (ICC)**
 - **Project focus:** Fertilizer Retention: the release of the Illinois Nutrient Loss Reduction Strategy (NLRs), the increasing pressure of corporate sustainability expectations and the continued pressure for climate change mitigation strategies are all resulting in an intensified agronomic focus on improving soil health and implementing agricultural management practices that maximize agricultural productivity potential while reducing environmental impacts. To meet NLRs goals alone, nearly all farmable acres in Illinois will have to modify management practices to some extent.

This has increased the demand for technical information relative to nutrient management, reduced tillage, use of cover crops and edge of field practices such as buffers and wetlands. Gaps in knowledge and implementation strategies are being identified and there is a growing need to educate farmers and their trusted advisors about a whole system approach. Water Quality: co-leading this topic area to examine the effects of in-field cover crops and directly measuring soil erosion from test plots.

- **Year 1 Summary:** The wetland project was approved by the college's Board of Trustees in May 2019 and was constructed during the week of July 23, 2019. The wetland will receive tile water from 50 acres on farmed land at the ICC campus. There will be automated water samplers before and after the wetland to monitor its effectiveness at nutrient removal. In addition, the wetland will have an automated water control structure to keep water levels in check during the year. Initial data showed that wetlands lose some of their effectiveness if they dry out during the summer. The college plans to limit that with the control structure. The wetlands were constructed as one of the Illinois Land Improvement Contractors Association (LICA) field days in conjunction with the ICC Agriculture Department and The Wetland Initiative. The public was invited to an open house each day, and an official field day with tour stops was provided. See attached flier, agenda, and news release that were used for this event. About 15 agency/agribusiness representatives and 40 farmers were in attendance for the field day. The wetland was seeded with a temporary seeding the week after construction was finished to prevent erosion and hold the wetland over until spring as the permanent plants would not have survived the winter if planted in early fall. The permanent seeding of grasses around the wetland was done in early February, and the plugs for the wetland will be installed in late May. As soon as the plugs are finished, then the wetland will be flooded with the tile water. In addition, the water monitoring stations will be installed this spring as weather permits. Starting this summer, faculty will be collecting water samples on the wetland as well in addition to the two other studies mentioned above. Additionally, the college started a new project looking at rates and timing of residual herbicides effect of fall planted cover crops. However, due to the late spring planting, late harvest, and early winter weather in Illinois they were not able to collect any valid data in 2019.
- **Year 2/2020 UPDATE:** 19 students participated in the AGRI 112 (Basic Soils) Fall semester course. The instructor took the students out to the plots and showed them all of the water testing sites and explained what research was being conducted and how the data could benefit farmers/landowners in the future. Class time was spent discussing nutrient loss and its effects on water quality and human health. The instructor is working on/using a PowerPoint lecture on Gulf Hypoxia for soils and soil fertility classes. The Soil Quality Test Buckets have been incorporated into a lesson on soil texture and aggregate stability and used in the soil labs to help students understand the concepts. Challenges: In this area, the amount of rainfall this past fall was much lower than normal,

so we have not run as many water samples as we usually would; I hope that will change this spring. Inkind donations: Several agencies are pooling some funds to buy our college a new rainfall simulator trailer; we should have it operational by late spring. Project impact on college/community: ICC has gotten a lot of press and people commenting about all of the work we do here at the college. I have farmers call me frequently to comment about how they appreciate the work we are doing here. The college has told us that they plan to re-work the pond on our campus in the next 12-24 months. They want me to expand the water quality testing to include the pond when it is finished. What that happens, we will be able to track nutrient loads and flow data from the time rainfall hits two of our plot fields until it leaves the ICC campus. We would be testing water in the paired field study, bioreactor, wetland, and then the outflow for the pond itself.

- **Year 3/2021 UPDATE:** ICC covers soil health in the Soils and Soil Fertility classes. For applied science students and transfer students, Soils classes are offered both spring and fall semesters. Soil Fertility is also available to applied science students in the Spring semester.
- **Northcentral Technical College (NTC)**
 - **Project focus:** Weed Resistance: the college is partnering in the development of this topic area to provide/assist with content to help producers and students understand additional tools to manage weed issues and demonstrate, where possible, the affect that soil health practices may help in weed management.
 - **Year 1 Summary:** Soil Quality Test Buckets were purchased and faculty will incorporate into the curriculum in Spring 2020. The college hosted 2 Field Days (Fall 2018 and Fall 2019), with demonstrations provided to attendees on corn planter technology with variable rate seeding and soil management using a soil pit. The soil pit examination showed the farmers the difference between the cover crop soil, which was like a sponge, and the non-cover crop soil, which was like a brick. Farmers provided positive feedback on this information and demonstration. In June 2019, the college hosted the Marathon County June Dairy Breakfast. The June Dairy Breakfast provided community neighbors and farmers a first-hand look into the dairy industry and the contributions it makes to Marathon County and all of the exciting opportunities that NTC and the NTC Agriculture Center of Excellence has to offer. On-Farm demonstrations were provided to nearly 3,000 attendees, including a rainfall simulator demonstration conducted by NTC Agriculture Faculty. The rainfall simulator was demonstrated throughout the event, showing the beneficial effects of conservation practices such as no-till farming, cover crops, residue management, and prescribed grazing effects that improve soil health and water cycling on agricultural land. Faculty requested attendees to sign-in to record how many people participated in the rainfall simulation demonstration. A total of 30 people (14 farmers) signed-in and provided positive feedback.

- **Year 2/2020 UPDATE:** No onsite events occurred due to COVID-19. NTC is actively pursuing a YouTube video series explaining our work for producers to watch anytime, anywhere. Faculty have utilized the soil data gained effectively in classes and virtual Field Day opportunities. Soil Quality Test Buckets continue to be utilized in various activities in the Crop Science curriculum, as well as in activities for high school agriculture presentations, and plans are underway to utilize in producer virtual Field Day videos. Successes: Lessons learned through virtual learning practices that have occurred due to the COVID-19 pandemic will be applied to working with producers and planning a virtual field day.
- **Year 3/2021 UPDATE:** NTC has utilized the soil data gained effectively in classes and at the virtual field day opportunities. We continue to utilize the activities within our soil health buckets. We not only utilize the soil health bucket activities within our Crop Science curriculum, but we also utilize the activities in high school agriculture presentations and plan to utilize in our producer field day videos.
- **Year 4/2022/Final:** NTC worked with the WI NRCS to present a Lunch and Learn on soil health in spring 2022. With the help of WI NRCS, a weather station was installed this summer with the intent to collect groundwater level information. A 6' hole was drilled and PVC installed to start this process. The weather station was placed over the top of this pipe and raw data can be observed from our smart phones. Future plans include soil moisture monitors in the apple orchard and the grape vineyard to allow the Ag Water Management class to irrigate when needed; they have already set up drip line and are ready to water as needed.
- **North Dakota State College of Science (NDSCS)**
 - **Project focus:** Physical/Biological Improvements: the college is leading the development of this topic area to provide content such as better structure, improvements to compaction, better infiltration, better nutrient and water holding capacities, increased organic matter, and increased biological activities to demonstrate what these improvements look like and share the connection to both erosion and water management. Water Management: the college is leading the development of this topic area to provide content such as the use of tools such as cover crops improve structure and infiltration to use excess water allowing for better trafficability and saline management. Through this process producers/students will learn the advantages as well as challenges of maintaining a longer growing season and using less tillage. Weed Resistance: the college is leading the development of this topic area to provide content to help producers and students understand additional tools to manage weed issues and demonstrate where possible the affect that soil health practices may help in weed management.
 - **Year 1 Summary:** Curriculum module outlines have been developed for the three areas: physical/biological improvements, water management, weed suppression. The college plans to have these documents completed and ready for use in Year 2 of the grant, particularly for the student/producer

field days in Year 2. Soil Quality Test Buckets were purchased and assembled to be used during the field days in project Years 2 and 3. The college had planned a student field day this past fall in which NRCS specialists could share with students the practical use of the field measures that use the bucket contents. Unfortunately, the weather was uncooperative and forced cancellation of two attempts. Additionally, the college has encountered agronomic challenges as getting the cover crop planted with wet conditions required waiting. Further, using equipment they do not own or often have ready access to has caused delays in some management practices. The college is working with partners to continue to improve this. A second challenge is getting more student access to the field, but they are continuing to look at class offerings to create as much opportunity as possible. There are many benefits the college is beginning to see with the land lab. Some of those things are indirectly associated with this grant such as the 4H Jr. Crop Scout School that will be held later this summer at the land lab. This will serve as a great opportunity to see what they have to offer at NDSCS and potentially serve as a recruiting tool. Another example is with a partner who will be able to use the land lab to show their producers both equipment and agronomic demonstrations. In turn, the partner is helping with this project by providing the equipment to put the land lab into productivity. They will also play a role as the college gets into the second and third years of this project with field days and producer education. Both of these events will take advantage of the beginning soil health minimal till/cover crop vs. conventional till demonstration started with this grant. Current students have had the opportunity to see the beginning stages of the land lab, and faculty believe they see the potential impact it will have on current and future student education. This project will allow students to see the development of implementing soil health practices and the changes over time.

- **Year 2/2020 UPDATE:** Other than one Field Day, NDSCS did not conduct any outreach events due to COVID-19. The PLSC 235L class occurred partially at the demo plot. Curriculum modules (physical/biological improvements, water management, weed suppression) are ready for use; plans to improve the weed suppression module is still in progress. Soil Quality Test Bucket lab kits were organized by lab topic and made ready for use including utilization in the Soil 210 lab sessions in the field.

Challenges: It is fair to say the time frame of this report things have been challenging due to COVID-19 issues. We had to move our original planning of field day from 3 throughout the summer to the one held June 30th. Further, we do believe that may have impacted public numbers attending this event. We are currently discussing ways to offer virtual field days to compensate for all of this. We also feel a deficit we have in this project is evaluation of learning. We need to do a better job of assessing pre-post measures. We learned some lessons regarding the difficult nature of this field in a hard-growing season. Water management is certainly key to this field, and many other challenges arise from that fact. In planning for the 2020 growing season, we believe addressing water management as our

priority will be important. It is important to us that we provide diversity in crop production on this field but more importantly how to farm it successfully given its challenges. Successes: We were able to purchase equipment to allow us to capture video field day segments. Late in this reporting period, we began the process of organizing content. With COVID, we were able to find at least another opportunity to use the demo plot for student learning. We were able to work with our John Deere/Diesel department to seed our cover crop this year. Those students were able to test equipment in doing so. It also gave us a chance to share some agronomic knowledge with those students. It was a fun thing. We were able to reach across the river to Wilkin County SCD to use their drill for this. In doing so, I believe we will have additional opportunities to share soil health activities with them. A good chunk of our students are from Minnesota so this will be a good connection. We were able to get the field prepped and planted within a reasonable timeframe. The Field Day was a success given the COVID-19 situation. We were glad to get our NRCS partnership in a stronger position. Out of two growing seasons, we believe we have had some value-added instruction. This field has provided great opportunity for engaged learning opportunities. We are realistic that more can be done but feel we are making strides in this area. Inkind donations: Grain trucks to haul at harvest. Seed, scouting, equipment. Project impact on college/community: I think this connection with Wilkin County SCD will be promising. There is potential to offer more expertise and tie a state from which we get students. Our unique location on the state border makes this a good thing in my mind. We have been in discussion with our John Deere/Diesel department to seek ways to work together. We have some ideas to get some fieldwork done while also benefitting the students in the Diesel department. Going through the previous cropping season, we were able to get additional input/advice/help with the field from community farm members. We believe this continues to build relationships and provide additional learning opportunities for our students. Along with that, we have added an additional advisory committee member to offer additional expertise.

- **Year 3/2021 UPDATE:** Continued curriculum development/modification implementation; continued video segment development; continued Soil Quality Test Bucket implementation.
- **Year 4/2022/Final:** Over the four years of the grant, curriculum and activities to demonstrate soil health practice effects on physical and biological soil properties were incorporated into courses and included in field days. This was done on our demonstration plots for no till/cover crops vs. conventional practices in a heavy clay soil. Many observations were done using the soil bucket tools to show differences. Developing student understanding of soil property capabilities and influences has been a key component of our efforts. Our approach is predicated on the idea that developing student understanding may influence practices on their farm or as consultants influencing farmers, as students move into their agriculture career. -- Weed management curriculum and

demonstration was primarily done through demonstration and field assessments. In Years 1-3, weed density measurements were taken to compare the demonstration plots. Essentially, weed density was less in the no till/cover crop plot than the conventional plot. Even with the difference in management, herbicide application was made to both sides due to the ease of application on the relatively small acreage of the demonstration plots. The final year we were unable to compare as cover crop was inadvertently planted on both sides of the demonstration plot. -- Water management curriculum was less developed than other areas in this project. Frankly, it was a time and equipment issue that prevented further development of curriculum and activities to implement. We did conduct some soil bucket health assessments to measure infiltration to determine differences but with the weather/environment on these heavy soils being relatively extreme each year, there were no discernable differences.

- **Northeast Community College (NCC)**

- **Project focus:** Support co-development with other colleges collaborative interest/expertise within sub-curriculum topic area(s). Northeast Community College will make extensive use of the new courses already in place to increase student knowledge of sustainable agricultural and conservation practices. The college's new Natural Resources educational program will be helpful in that regard. NCC students will be involved in the field days where information learned will be shared with producers from the area.
- **Year 1 Summary:** A considerable amount of planning work occurred in the first year at Northeast Community College to set the stage for actual soil erosion applied research as the grant continues. Two courses have been successfully developed at thanks to this grant: Intro to Natural Resources (implemented in Spring 2019 and continued in the Fall 2019 semester) and Agroecology (first offered in the Spring 2020 semester). There were fewer than 10 students enrolled in the Intro to Natural Resources course in Spring 2019, and that increased to 11 students in the Fall 2019 semester. Work is under way to transform the Agroecology class into an online offering that will be available for the Spring 2021 semester.
 - The involvement of the advisory panel up to this point has focused on individual consultations and/or conversations with members. Their interest and willingness to be involved with this project continues. But they are busy with their own agricultural careers and activities and, in light of the less-than-ideal weather patterns that were experienced in Nebraska this growing season, a consensus was reached that it would be best to wait for February 20, 2020 to hold the annual meeting of the advisory panel.
 - Soil Quality Test Bucket implementation: Since the Natural Resources Conservation Service in Nebraska previously distributed soil health buckets, Northeast Community College chose to complement their presence by purchasing what are known as Munsell Soil Books. Their use will assist students in determining the color of their soil and then

are able to see the differences in dark- or light-colored soil. These books will serve as a valuable addition to the instructional tools available to faculty and students.

- Numerous faculty members attended and participated in the annual C2A3 conference that was hosted by NCC in late September 2019. At the conference, curriculum ideas were shared from all schools, and discussion ranged across broad topics – like what are the most important concepts faculty are teaching (like soil texturing) to much more specific, such as how to test knowledge gained in a module by having the students build posters. Northeast faculty members showcased field scout monitors and how they can fit into different classes (such as soil science and intro to ag tech).
- Northeast Community College was able to start a Natural Resource degree for students to pursue. The new degree came about based on the meetings and discussions the C2A3 consortium has had in regard to the need for something like this. While still early in its existence, this degree has been well received throughout the college's 20-county service area, including high school guidance counselors, potential students, industry representatives, and others. The college anticipates this degree program to grow and serve as a tangible, valuable addition to the college's agriculture-related offerings.
- **Year 2/2020 UPDATE:** Year 2 of the Project included a considerable amount of planning work at NCC in Norfolk, NE, to set the stage for actual soil erosion applied research as the grant period continues. The Agroecology course was approved for spring 2021 in an online format. This course was developed for sophomore level students. NCC graduated three students under the Natural Resource associate of science degree in its second year offer the degree. Curriculum utilizing the Munsell color books was added to the NCC C2A3 SharePoint site in FY 2020. Corn stalk nitrate test curriculum and Solvita soil health testing curriculum were added. The broad thread curriculum (soil health, cover crops, no-till agriculture) will be built from existing content from additional potential postsecondary educational partners and purchasing and customizing tools available from the USDA Natural Resources Conservation Service. Video interviews were conducted with Advisory Panel members, as well as NCC staff and faculty, to begin developing videos and curriculum to be played at virtual field days in the future. These videos will be developed into a real-life case study in order to show the significant changes that can happen to soil in a relatively short amount of time. NCC will make extensive use of the new courses already in place to increase student knowledge of sustainable agricultural and conservation practices. NCC's new Natural Resources educational program will be helpful in that regard. NCC students will be involved in the field days where information learned will be shared with producers from the area. K12 outreach and courses were on hold due to COVID-19 restrictions. NCC's ag instructor applied for a dual credit teacher license in the State of Nebraska, which she was awarded.

Successes: Video transcript and video development has been building during the last portion of Year 2. This will allow instructors across the US to see a real-life case study of a small field. This case study video will highlight not only the importance of soil health but also how to achieve soil health quickly and safely.

- **Year 3/2021 UPDATE:** NCC's relatively new Natural Resources degree has been building momentum; there are now three full-time students in the major, along with several other full-time students looking to double major with the Associate of Science Natural Resources degree. Construction of the new vet tech building is nearly complete, but the farm operations facility was delayed due to pandemic-related supply chain issues. Although Rob Thomas, who served as the College's farm manager, left his position in September 2021, soil sampling and cover crop planning were able to happen before he departed; manure application, however, was not feasible because of weather issues. Shooting of video footage to be utilized in the grant's curriculum project was completed in December 2020; NCC is utilizing the college's marketing department, as well as broadcasting students, to help edit the footage pertaining to soil health and marginal soils to result in a finished product able to be shared.

Broad thread curriculum (i.e., soil health, cover crops and no-till agriculture) is being built from existing content from additional potential postsecondary educational partners and purchasing and customizing tools available from the USDA NRCS. NCC worked to develop a video to work with its sampling data in order to develop curriculum for schools that do not have access to a farm or an area to do applied research; the college's marketing department developed a schedule/timeline for the production of the video. Video interviews were conducted with advisory panel members, as well as NCC staff and faculty, to develop videos and curriculum to be played at virtual field days in the future. These videos will ultimately be developed into a real-life case study in order to show the significant changes that can happen to soil in a relatively short amount of time.

- **Year 4/2022/Final:** Curriculum for this project was completed in December 2022. Components include: videos to introduce material, discussion topics, hands-on field ideas, and questions pertaining to USDA SARE-published books. Starting on December 15, 2022, these materials were available on the C2A3 SharePoint site.

- **Northeast Iowa Community College (NICC)**

- **Project focus: Manure Management:** historically manure application has been looked at mainly as just a waste product that needs to be disposed. Producers are starting to become more aware of the importance of manure and its impact on soil health, crop production, and the environment. The correct application of manure can have a direct positive impact on soil health although too much manure can cause an adverse effect on soil health and the environment. Northeast Iowa Community

College's Livestock Nutrient Management (AGA 159) class covers nutrient values, application rates, and techniques. Soil Erosion: this topic is specific to regions located in a heavy livestock area made up primarily of beef and dairy cattle. Historically the reason for the heavy cattle presence is because of hilly ground and the need of hay or pasture in the rotation. With increasing concentrations of cattle, producers are now relying more on chopped corn silage which provides more feed per acre and less reliance on pasture and hay. New cropping practices leaves the ground with little residue in the fall and susceptible to erosion. If the erosion is not managed the environment and long term productivity of the soils will suffer. Soil aggregate stability is a big component of soil health. Controlling soil erosion has a direct positive impact on soil aggregate stability and soil health. NICC is working on new curriculum related to soil health and erosion including but limited to compaction, fertilizer retention, water and wind erosion, and soil biology and sustainable soil practices.

- **Year 1 Summary:** Year 1 focused on curriculum development and initializing outreach efforts. The implementation team has analyzed the progress made and has reached out to other departments at the college to help ensure outcomes are met.
 - In the first year, curriculum was modified for the Livestock Nutrient Management (AGA 159) and was taught at NICC Fall 2019. Discussion topics are in development for Soil Erosion and its impact on Soil Health in the C2A3 SharePoint web site; this material was presented to fellow faculty members at the C2A3 Conference September 2019. Additionally, the soil conservation curriculum is being developed to accompany the soil quality test bucket which was purchased in the first year of the grant. NICC is proud to be developing a greater awareness of how to take care of the land and soil which leads to increased profitability and better environmental stewardship.
 - The NICC Agriculture Program has lost two (2) full-time instructors in the past year who have not been replaced. Being short staffed has impacted the college's ability to implement all activities. Plans are to have one of the positions filled by Spring 2020.
 - This project has increased the college's emphasis on stewardship of land and soil health. Soil health is an important part of a sustainable agriculture future and even though there is a lot of interest in properly educating the public, it is a difficult process. Students have been educated in the best management practices for livestock nutrient management and will incorporate these in their future careers. Ag Educators have a greater awareness of topics related to soil health and teaching materials.
- **Year 2/2020 UPDATE:** NCC completed curriculum for a Structure of Livestock Nutrient Management course; the course began being offered/taught Fall 2019. Soil Health curriculum is completed and uploaded to the C2A3 SharePoint, which includes Unit 1—Soil Sampling, Unit 2—Bulk Density, Unit 3—Soil Organic Matter, Unit 4—Soil Respiration,

Unit 5—Soil Electrical Conductivity. The AGA 114 (Principals of Agronomy) was taught Fall 2020. Soil Quality Test Buckets used for Soil Conservation curriculum and AG114 (Agronomy) curriculum. Challenges: A link to pre-/post-tests were provided to viewers of the virtual Field Day, but no one participated. The NICC Agriculture program lost two full-time instructors and replaced one; hiring has been impacted by the COVID-19 pandemic and contributed to delayed activities. Soil health is an important part of a sustainable agriculture future, and even though there is a lot of interest in this, properly educating the public is a difficult process. Successes: NICC hired a new Agriculture, Animal Science, and Transportation Dean (Bruce Bearinger) during Summer 2020. Conducted a virtual field day in cooperation with NRCS office and the Northeast Iowa Dairy & Agriculture Foundation. Created a curriculum for the Soil Quality Health Buckets and shared with the participating consortium colleges. For being offered for the first time, the virtual Field Days format worked fairly well; just need to increase involvement and return on surveys. Project impact on college/community: NICC is proud to be developing a greater awareness of how to take care of our land and soil which leads to increased profitability and better environmental stewardship. The project has increased the college's emphasis on stewardship of our land and soil health. The grant is helping to strengthen relationships between the different departments in the college and its partners.

- **Year 3/2021 UPDATE:** Manure management curriculum was broken down into curriculum packets for the NICC Summer Agriculture Instructor Faculty Workshop. The AGA114 Principles of Agronomy (Fall 2020/Fall 2021) class includes five labs using the soil health buckets. Instructional materials were developed that include the soil quality test buckets for the NICC Summer Agriculture Instructor Faculty Workshop. Students have been educated in the best management practices for livestock nutrient management and will incorporate these in their future careers. NCC will make extensive use of the new courses already in place to increase student knowledge of sustainable agricultural and conservation practices; the college's relatively new Natural Resources educational program will be helpful in that regard.
- **Year 4/2022/Final:** Curriculum was completed in Year 2. The Structure of Livestock Nutrient Management Course (AFA 159) began Fall 2019 and the Principals of Agronomy (AGA 114) started Fall 2020. The completed Soil Health curriculum was shared via the C2A3 SharePoint site. The curriculum includes Unit 1: Soil Sampling; Unit 2: Bulk Density; Unit 3: Soil Organic Matter; Unit 4: Soil Respiration; Unit 5: Soil Electrical Conductivity.
- **Richland Community College (RCC)**
 - **Project focus: Carbon Storage:** Richland Community College is a partner in the Illinois Industrial Carbon Capture and Storage (IL-ICCS) project, the largest geologic storage project in the U.S. to store CO₂ in a deep saline

formation. Cover crops may further offset the rise in atmospheric CO₂ levels through terrestrial carbon storage in above ground plant tissue and in soils as top growth and roots decompose. RCC will lead the development of this topic area to provide content such as the use of cover crops to offset the rise in atmospheric CO₂ levels through terrestrial carbon storage. Water Quality: subsurface tile-drainage systems are a major source of nitrate (NO₃⁻) loss from farmland, contributing to the Gulf of Mexico hypoxic zone and harming aquatic life. Additionally, high nitrate levels can pose human health risks by impairing the ability of blood to carry oxygen. Cover crops can protect water quality by taking up excess soil nitrogen, which is then stored in plant biomass. RCC will co-lead this topic area to examine the effects of in-field cover crops and an edge-of-field bioreactor on nitrate loss from farmland.

- **Year 1 Summary:** In the first year of the project, RCC agricultural faculty and staff expanded their knowledge about sustainable soil health practices. In turn, they developed curriculum and disseminated information about soil health to RCC students in the classroom and producers via field days.
 - Faculty began teaching AGRIC 210 Soil Science in fall 2019 semester and have updated the course syllabus and course content based on resources and information gained from the soil health bucket training.
 - RCC is very appreciative of the grant and the opportunity to collaborate with other colleges throughout the Midwest. The sharing of knowledge that has and will occur via this grant has the potential to be very impactful beyond what we currently may think possible.
 - RCC was happy to host the 20+ farmers from throughout the district and beyond who attended the cover crop choices event that was held with the Prairie Beef Association. For this first joint event, RCC was very happy with the attendance and feedback. It should prove to be a first step in the continuation of a partnership on future training events. This is very positive for the RCC agriculture program as faculty have a desire to increase engagement with the agribusiness community in order to increase student enrollment after re-launching the agriculture program this fall.
- **Year 2/2020 UPDATE:** In Year 2 of the Project, RCC agriculture faculty and staff developed and improved curriculum for the AGRIC 210 Soil Science course which was taught in the Fall 2020 semester; offered the AGRIC130 Crop Science course in Spring; course syllabi, content, and laboratory activities were updated based on resources and information gained from various soil health professional development activities completed by RCC Agriculture staff. Developed instructional and lab resources related to the soil health using the Soil Quality Test Buckets; activities were incorporated into the Fall 2020 Soil Science course and will be used in high school agriculture course presentations/activities and producer field days. Project impact on college/community: RCC is excited for the improvements to the AGRIC 210 Soil Science and AGRIC 130 Crop Science courses that have

occurred due to this grant initiative. We have utilized curriculum planning time to implement Soil Health bucket activities into the courses lab instruction. We look forward to continued improvement and enhancements to the course. RCC is excited for the developing partnership between our Agricultural Program and the Macon County Soil and Water Conservation District. We believe that both of us will benefit by coordinating of efforts and the synergies developed would not have occurred without our involvement in this SARE grant initiative.

- **Year 3/2021 UPDATE:** In Year 3 of the grant, Richland Community College agricultural faculty and staff expanded their knowledge about sustainable soil health practices. In turn, we developed curriculum and disseminated information about soil health.

The AGRIC 210 Soil Science and AGRIC 130 Crop Science courses were offered in the fall 2021 semester. The lecture content and laboratory activities were updated based on resources and information gained from various soil health professional development activities completed by RCC agriculture staff throughout the year, which included attending the Illinois Conservation Cropping Seminar and a half-day training with David Brandt and Walt Lynn regarding the Soil Health Academy online teaching resources. 18 college students enrolled and completed our AGRIC 210 Soil Science and AGRIC 130 Crop Science courses. The course content and labs were modified as a result of this initiative to increase the emphasis on soil health best management practices.

Soil Health Bucket implementation: We have continued to improve upon the laboratory activities within our soil health bucket. We not only utilize the soil health bucket activities within the AGRIC 210 Soil Science course, but will also utilize the activities in high school agriculture course presentations. Due to the pandemic, we were unable to host produce field days this year. Thus we were unable to utilize the soil health bucket for that audience this year, but have done so in previous years.

- **Year 4/2022/Final:** The COVID-19 pandemic without a doubt impacted our efforts for a year or more of the grant period, but we did make the most of a bad situation by utilizing our time working remotely to focus our efforts on curriculum development and improvement. The following RCC agriculture courses were modified to incorporate best management practices related to soil health and the use of cover crops: AGRIC 210 Soil Science, AGRIC 270 Soil Fertility & Nutrient Management, and AGRIC 130 Crop Science. The lecture content and laboratory activities were updated and/or developed based on resources and information gained from various soil health professional development activities (Illinois Conservation Cropping Seminar, Soil Health Academy online course overview by David Brandt and Walt Lynn, etc.) attended by agriculture staff throughout the grant period. Additionally, a Regenerative Agriculture certificate program was added to our Crop Science AAS degree. As part of the new certificate, we developed curriculum for two new courses for

the Regenerative Agriculture degree – Introduction to Regenerative Agriculture practices and Introduction to Natural and Water Resources.

Year 2/2020 UPDATE: 3) Succinct Statement of Research Solutions

- Clark State Community College: The field was sampled and soil test results indicated a phosphorous deficiency; phosphorous was applied at a rate of 2 lb P/1000 ft² to correct the deficiency. Dent corn (*Zea mays* var. *identata*) was planted in late May and early June; a 100-day, Round-up ready variety was used; installed soil containment apparatus to monitor soil erosion, which were removed on October 5th and there was almost zero erosion on all of the plots measured; in addition, soil compaction was measured with a penetrometer; on October 6th, the corn was harvested; there was some pest (deer) issues over the summer and due to being a newly-tilled field there was an abundance of annual grassy weeds. Weed population primarily consisted of foxtail (*Setaria* sp.), crabgrass (*Digitaria* sp.) and pokeweed (*Phytolacca Americana*). Due to the weed infestation the field was re-tilled and cover crops were planted on October 8th. The cover crops planted were rye (*Secale cereal*), radish (*Raphanus sativus*), and clover (*Trifolium incarnatum*); the soil containment boxes we put back in the field; as of early December, the radish plots were performing the best averaging about 90% visual cover. In addition, alternative crops were planted in early June. These were oats (*Avena sativa*), barley (*Hordeum vulgare* and sorghum (*Sorghum bicolor*). Of these crops sorghum performed best as the other two being much shorter were more susceptible to weed competition. These plots were used in classes to demonstrate why certain management practices are employed to maximize yield and to conserve resources.
- Illinois Central College: ICC partnered with Waterborne Environmental and Illinois State University (ISU). ISU does all of the water testing in its lab. Results are sent to Waterborne to tie the concentrations of nutrients to the amount of water flowing from the water control structures to create the total nutrient load leaving the sites. Cover crops and the bioreactor work to decrease nutrient loads in tile water. Cover crops can reduce nitrogen loads up to 40%, depending on the year. The bioreactor does a good job of reducing nutrient loads, but only a portion of the total flow in the tile water goes through the bioreactor. The wetland has not been active long enough to give any valid results yet. This next year should start generating solid data.
- North Dakota State College of Science: More water management needs to be done on the field. Some surface drainage was able to be done. It remains to be seen if this was enough.
- Northeast Community College: Due to construction on the NCC campus, the original SARE grant field needed to be moved; the field was relocated successfully before the 2020 growing season, and soil samples were collected. The NCC Advisory Committee Chairperson is a seed dealer and will be doing research and reporting back to NCC on any unusual or promising cover crop species available to Northeast Nebraska that could be used in the classroom for identification purposes, as well as regarding beneficial properties of the plants; the goal is to

plant some of these cover crops to provide NCC students with hands-on experience. Video interviews were conducted in December 2020 (pandemic-related health directives were followed) to start building classroom and producer curriculum for virtual field days. These videos will be supplemented with soil sampling data, as well as cover crop species selection for students and producers to be able to delineate information. Video production should be completed in Year 3. Successful soil sampling, planting, growing, harvesting, manure application, and sampling occurred in Year 2 on the new site (due to NCC construction).

Year 3/2021 UPDATE:

- Central Lakes College: We had a difficult summer dealing with extreme drought. Our 60" corn trial with cover crop planted within the rows struggled to keep enough water to perform well. Our biomass sample showed 595# per acre of dry mass that would be available to graze cattle. This also made it difficult to provide enough water for the start of the cover crop. The cover crop grazing potential of early seeded cover crops behind crops that are harvested early, such as potatoes or kidney beans, provides an opportunity to generate a fair amount of biomass to support cattle. Our 60" corn trial actually provided a decent yield while allowing forage to grow amongst the rows throughout the growing season.
- Clark State College: The field was sampled and soil test results indicated a phosphorous deficiency. Phosphorous was applied at a rate of 2 lbs P/1000 ft² to correct the deficiency. Dent corn (*Zea mays* var. *identata*) was planted on May 14th. A 100-day, Round-up ready variety was used. Installed soil containment apparatus to monitor soil erosion. These were removed on October 11th and there was almost zero erosion on all of the plots measured. In addition soil compaction was measured with a penetrometer. On October 11th, the corn was harvested. The corn harvest was down significantly this year as compared to the year prior. However, there were no differences between cover crop plots. There was some pest (deer) issues over the summer and due to being a newly-tilled field there was an abundance of annual grassy weeds again. Weed population primarily consisted of foxtail (*Setaria* sp.), crabgrass (*Digitaria* sp.) and pokeweed (*Phytolacca Americana*). Due to the weed infestation the field was re-tilled and cover crops were planted on October 12th. The cover crops planted were rye (*Secale cereal*), radish (*Raphanus sativus*), and clover (*Trifolium incarnatum*). The soil containment boxes we put back in the field on October 13th. As of early December the radish plots were performing the best averaging about 90% visual cover. These plots were used in classes to demonstrate why certain management practices are employed to maximize yield and to conserve resources.
- Northcentral Technical College: NTC has established four identical test plots that we feel provide consistent and accurate data for comparison. We installed signage around the test plots, and people in the community are starting to recognize the work we are doing with this grant.
- Northeast Community College: Wolken Seed Co. will be doing research and reporting back to the college on any unusual or promising cover crop species available to NCC that could be used in the classroom for identification purposes,

as well as regarding beneficial properties of the plants; the goal is to plant some of these cover crops as a way to provide NCC students with hands-on experiences with them. Video interviews were conducted in December 2020 (pandemic-related health and safety measures were in place) to start building classroom and producer curriculum for future virtual field days. These videos will be supplemented with soil sampling data as well as cover crop species selection, for students and producers to be able to delineate information from. Successful soil sampling, planting, growing, harvesting, and sampling again occurred in Year 3. Manure application was not able to happen due to weather issues.

- Richland Community College: Carbon Storage: Richland Illinois Community College is a partner in the Illinois Industrial Carbon Capture and Storage (IL-ICCS) project, the largest geologic storage project in the U.S. to store CO₂ in a deep saline formation. Cover crops may further offset the rise in atmospheric CO₂ levels through terrestrial carbon storage in above ground plant tissue and in soils as top growth and roots decompose. Richland Illinois Community College will lead the development of this topic area to provide content such as the use of cover crops to offset the rise in atmospheric CO₂ levels through terrestrial carbon storage.

Water quality: Subsurface tile-drainage systems are a major source of nitrate (NO₃-) loss from farmland, contributing to the Gulf of Mexico hypoxic zone and harming aquatic life. Additionally, high nitrate levels can pose human health risks by impairing the ability of blood to carry oxygen. Cover crops can protect water quality by taking up excess soil nitrogen, which is then stored in plant biomass. Clark State University (OH), Illinois Central College, and Richland Community College (IL) will lead this topic area to examine the effects of in-field cover crops and an edge-of-field bioreactor on nitrate loss from farmland.

Year 4/2022/Final: Noted in Research section.

4) Farmer adoption actions that resulted from the education program. A beneficiary outcome story may be included optionally:

In Year 1 of the project, colleges focused on constructing and hosting advisory panels/committee meetings (composed of Team Leads, producers, agricultural students, and Extension contacts), outreach, and researching and collaborating on “common thread” curriculum regarding soil health. While the majority of farmer/producer education will occur in years 2 and 3 of the project, some colleges did host events for farmers/producers where soil health was discussed or demonstrated (see Project Activities and Educational Outreach Activities sections of report for details). Although it is early in the project, 2 farmers have adopted actions/practices and are incorporating the use of cover crops into their operations to increase soil health. Additionally, all participating colleges have reported an increased awareness and interest in the use of cover crops by farmers/producers who have attended events. Colleges are receiving phone calls and questions from area farmers/producers regarding cover crops and the work that is currently being done. One college receives an average of 5 phone calls per month and has begun conversations with a local farmer on assisting them as they transition their farm to organic production and will

include Agriculture student involvement for the teaching/learning aspect that this could provide.

In the first year of the project nearly 250 farmers, 340 agriculture professionals, and over 100 agriculture students participated in workshops, field days, and were taught new curriculum related to soil health practices. It is anticipated that over 700 producers will participate in the regional workshops or field days over the course of the grant. In addition, each of the eight partnering colleges will continue to consult with local producers, such as farmers and ranchers, who will provide insight on content that meets local agriculture needs. As the project activities progress into year 2, colleges will continue to expose agricultural community/technical college students and producers to curriculum, educational materials, and host producer workshops or field/demonstration days within their communities.

Year 2/2020 UPDATE: The following information includes collaborations/partnerships and producer impact.

- Central Lakes College: CLC partnered with two beef producers and a landowner. The Landowner seeded winter rye for cover crops on roughly 200 acres; CLC seeded another 65 acres. Cattle producers maintained fence for cattle and brought cattle to graze in Fall 2020. This mean maintaining fresh water for cattle with the use of a semi tanker and drinking system. Roughly 132 acres of corn stubble was left by CLC. 150 cows and 128 calves were brought in for grazing from October 24 – November 13, 2020. An estimated 85.05 tons/\$10,632.25 of forage were consumed by the cattle, resulting in weight gain for almost all 128 calves; producers weighed calves on October 23, 2020, and will have final weights after being sold. The 150 cows, however, seemed to lose weight and body condition over this period, with some losing an estimated 100 pounds each. Haney soil tests were taken to compare with future samples in order to analyze any improvement in soil health as a result of this grazing over time. CLC hosted a Field Day on August 21, 2020 with approximately 85 people attending.
- Clark State Community College: CLC participated on a local food/agriculture workgroup on how to further agriculture and the food industry locally.
- Illinois Central College: Many of ICC's agriculture program students return to their family farms after college. Many take the information gained on cover crops, soil health, fertilizer use, and water quality back to their farms. The instructor is hopeful that many of them will change some of their farm practices due to their educational experiences. COVID has limited ICC's ability to have events on campus, and farmer meetings have not occurred since March 2020.
- North Dakota State College of Science: RDO Equipment planted the 30-acre demo field, conducted tillage equipment demonstrations, provided a combine and harvested the crop, and did some surface ditching to help with drainage; list of roles and responsibilities to better manage the growing season was identified including all inputs, field practices through the season, harvest, and post-harvest activities; RDO played a significant role in the NDSCS Field Day (June 30, 2020; agenda attached), providing expertise, equipment and demonstrations. The North Dakota NRCS met with college staff/faculty to look at resource concerns reporting and helped identify key steps that need to be taken to manage the concerns;

testing protocols were identified; soil tests to be scheduled were identified; NRCS staff participated in collecting data such as soil health testing and bulk density; NRCS staff assisted with water management/buffer strips to deal with resource concerns; NRCS staff played a key role in the June 30, 2020, Field Day providing instruction on soil health practices and soil pit evaluation. Wil-Rich planted the cover crop with one of their top-of-the-line air seeders, allowed NDSCS staff/students to ride along as well as the get the cover crop in the ground; in turn, the Wil-Rich people tested out NDSCS's new equipment and learned from their end. The NDSCS Diesel Department provided the tractor to plant the cover crop in the demo plot; this was an opportunity for Diesel program students to operate their equipment in a field setting. Farmers Union of the Southern Valley worked with NDSCS to identify inputs that could be accessed for the crop and worked with the college for herbicide and fertilizer applications for all acres; they were key in finding seed for the demo plot, assisted with getting chemical inputs, and made agronomic recommendations.

- Northcentral Technical College: NTC has developed relationships with local and state NRCS staff, working with them to develop a comprehensive conservation plan for the College farm; four NRCS representatives met with NTC staff quarterly to discuss and develop future plans for research and conservation efforts on the farm. NRCS identified an opportunity for NTC to install a Pollinator Plot to develop habitat for pheasants and pollinators. NTC is partnering with Pheasants Forever to identify and select plant species for the pollinator plot, ensuring it is prepared properly with all existing plants terminated and ready for spring planting. NTC works with Triple L Drone Services to capture aerial footage of NTC farm fields, using video and still pictures to demonstrate effectiveness of work in the fields.
- Northeast Community College: The Chairperson for the NCC Project's Advisory Committee owns and operates Wolken Seed Co. He is a valuable resource and has been able to participate in meetings to discuss potential species for cover crop mixes for planting in August; he also took part in taped interviews that discuss soil health which will be used at a later date.
- Northeast Iowa Community College: Norman Borlaug Heritage Foundation engaged with NICC in planning and hosting a fall Field Day (10/11/2019); the Foundation hosted the event, organized the activities and agenda for the day, and invited participants; 14 students participated; agenda attached. The Northeast Iowa Dairy and Agriculture Foundation partnered with NICC to host, organize, and invite producers to a virtual Field Day on soil health called "Different is Good: What Different Plants Can Do for Your Soil" (6/30/2020); the Natural Resources Conservation Service of Iowa presented as a guest speaker; 20 participants; the Foundation submitted a press release for the virtual Field Day (attached); the YouTube video of the virtual Field Day/webinar continues to receive new views and comments (attached).
- Richland Community College: All planned events were cancelled due to the COVID-19 pandemic. RCC Agriculture staff met with Macon County Soil and Water District (MCSWD) staff to discuss how to collaborate on educational programs and field days (planned agenda topics attached), planning to partner with them in hosting a producer strip till field day; however, it was cancelled due to COVID-19

pandemic. Collaborated with MCSWD to develop a 20-hour per week internship for a RCC Agriculture student; MCSWD implemented the internship and provided funding. RCC partnered with Western Illinois University and Illinois State University to plant Pennycress cover crop plot; Western Illinois University and Illinois State University coordinated the production practices for the Pennycress cover crop plot on RCC's campus with the intent to research the viability of Pennycress as a cover crop.

Year 3/2021 UPDATE:

- Central Lakes College: CLC producer partners, Mike Sams and Roy Bell, grazed cattle on 265 acres of rye that was seeded in the fall. Approximately 200 head of cattle grazed the cover crop for about one month. RD Offutt Farms then mowed off the remaining rye, tilled, and seeded potatoes. CLC seeded dark red kidney beans on 122 acres that will serve as a cover crop for grazing following harvest. CLC also seeded 8 acres of corn in 60" rows and seeded cover crops between rows around the V5 stage; 3 acres of corn in 30" rows was planted in the same manner as a check. RD Offutt Farms seeded one bushel of rye and one bushel of oats per acre on 397 acres after kidney beans and potatoes were harvested. NRCS's Jeff Duchene and Lance Smith helped with a biomass sample for grazing in the college's 60" corn demonstrations. COVID restrictions began to lift in May/June 2021 but hindered activities over the summer. Partners contributed through cattle, crops, soil health, curriculum, harvested potatoes, seeded cover crop, and sample biomass for grazing.
- Clark State Community College: Building new relationship with a local urban farm. Have worked with local high schools to allow them to teach our courses for college credit. We believe this upcoming growing season we will be allowed to host an in-person field day. We also have established a good-working relationship with our state NRCS and are very much looking forward to hosting the C2A3 Annual Conference next fall; we have already begun planning.
- Illinois Central College: COVID continued to impact field days and COVID policies made bringing outside people onto campus very difficult. Pete was invited to speak at the Bi-State Soil Health Training in the summer; this is a very high level train-the-trainer training for farmers and industry representatives and agency staff; trainings are quarterly and each training is a full two days; the entire class takes two years to complete. Each cohort is made up of approximately 50 producers, agency staff, and retail employees in soil health. ILL is planning a field day in late Summer/early Fall 2022.
- North Dakota State College of Science: NDSCS collaborated with several partners in Year 3. Farmers Union of the Southern Valley continued to be a resource for inputs as well as providing advice on crop management; FUSV was key in finding see for the demo plot, and they provided some herbicide at no cost as well. Mosaic Co. paid for the fertilizer and application for the land lab, presented at an NDSCS field day, and provided expertise in fertilizers; payment of the input and its application were very helpful. Butler Machinery provided a combine for harvest for both soybeans and corn, which allowed student to experience the new Fendt

combine. Minn-Kota trucked for the harvest and provided herbicide application; they hauled grain to the elevator and made one of the herbicide applications. ND NRCS continued to provide direction on managing resource concerns on the land lab; they conducted field tests again in the Fall of 2021 and share information to monitor the demo plots; with NRCS, NDSCS developed a conservation plan for the demo plot areas; Jordaan Thompsons from ND NRCS participated in one of NDSCS' summer field days. We continue to see the value of the land lab and this project. We also know that we have many more resources needed to fully implement all aspects of this project. Resources such as time and equipment are at the top of the list. Both of those are limitations given our current funding for the Agriculture department which is a scope beyond this project. Another thing we have noted is we have terrific producers/businesses in our area that are willing to support us with equipment and other needs. The challenge at times is that the scheduling of these things may not always as timely as we might like. Still, the assistance is greatly appreciated, and we could not do this field project without them.

- Northcentral Technical College: NTC has been working with local and WI NRCS staff to develop a comprehensive conservation plan for NTC's farm. NRCS representative's meet with NTC staff quarterly to develop future plans for research and conservation efforts on the college farm. Representatives also helped with Field Day and class presentations. Pheasants Forever helped NTC and NRCS staff identify and install a pollinator plot to develop habitat for pheasants and pollinators. Seed was planted in the spring. The pollinator plot grew well throughout the year. Pheasants Forever provided input on the care of the plot and we expect to see flowers next spring. Triple L Drone Services was used to document aerial footage of our fields through drones. Video and still pictures were provided to demonstrate effectiveness of our field work. NTC created two videos and was able to hold an in-person Field Day in October 2021. Unfortunately, due to the beautiful harvest weather that day, only students attended the event. NTC ag faculty, students, and staff participated in Wisconsin Valley Fair, June Dairy Breakfast, Pumpkin Painting Contest, State FFA Convention, State and National PAS competitions (virtually), Food for America, Dual Credit Days, College Exploration Days, Summer Camp Fun, and other high school visits.
- Northeast Community College: A large field day was held September 1, 2021, which brought together producers, FFA Chapters, and college students. This event focused on what applied research is happening on NCC's Acklie Family Farm, including the USDA SARE grant field. The SAE presentation focused on the "why" of soil health...why it is important to field productivity, as well as how it is important to the consumer and producer. Many positive comments were received on the day-long field day which featured various stations set up through the NCC farm for presentations to take place. Ben Wolken, owner and operator of Wolken Seed Co. based in Madison, NE, serves as chairman of NCC's project advisory committee. He is a valuable resource and has been able to participate in meetings with NCC representatives to discuss potential species for cover crop mixes for planting that took place in August 2021. Wolken was a speaker at the college's September field day along with his employee, Logan McKeon.

- Northeast Iowa Community College: NICC worked with several partners in Year 3. Keystone Area Education Agency worked with NICC faculty to enable participants to receive continuing education for the June workshop; they provided CEUs for the workshop for high school ag instructors (2 instructors claimed CEUs). NRCS worked with NICC faculty to plan webinars and workshops and assisted with topic suggestions and speakers. Northeast Iowa Dairy & Agriculture Foundation hosted the Tri-State Ag & Dairy Expo (in partnership with Iowa State University Extension and Outreach and NICC); they hosted the Expo at Iowa's Dairy Center; personnel spent time planning and coordinating event logistics and arranging for speakers; Brodie Bushman, Foundation employee, also spoke to FFA members about the importance of cover crops and the impacts it has on both soil health and dairy cow health. The Iowa State University Extension and Outreach hosted the Tri-State Ag & Dairy Expo (in partnership with Outreach Northeast Iowa Dairy & Agriculture Foundation and NICC); personnel spent time planning and coordinating event logistics and arranging speakers. NICC and its partners published two Soil Health Coffee Talks (virtual field day events) on the Iowa Dairy Center YouTube: 1) Soil Health Coffee Talk: Getting to the Root of the Problem. On this episode: Chris Jones, IHR Research Engineer, "Balancing an Ag Economy with Clean Water and a Healthy Environment"; Lisa Holscher, Director CCSI, "The Root Project"; Tessa Rother, Resource Conservationist, Vinton Team, "The Hidden Half of Nature" by David Montgomery; and 2) Soil Health Coffee Talk: Cover Crop Goals, Measuring Biomass & Planting Considerations. On this episode: Neil Sass, ARSS, Overview and summary of cover crop studies: weed suppression, N scavenging, erosion control, grazing, carbon sequestration soil health, live root, diversity, etc.; Jacob Groth, RTL Decorah, Measuring biomass, GDD's, growth rates, and other observations; Todd Duncan, DC Winneshiek, Planting green/planting into high residue.
- Richland Community College: RCC hosts the Farm Progress Show every other year on our campus. We met with Farm Progress Show staff a multiple times to discuss options for highlighting the use of cover crops as part of the show. It is an opportunity to reach a large number of producers and others in involved in agriculture to build their knowledge and understanding of cover crops role in building soil health. Farm Progress Show staff provide their time and expertise to determine how we could implement cover crops successfully into a field demonstration plot that is utilized during the Farm Progress Show. Richland Community College agriculture staff also writes articles for the Macon County Soil and Water Conservation District newsletter regarding our program and efforts related to soil health.

Year 4/2022/Final: All of the college's found ways to share soil health best practices with producers through conversations, field days, workshops, and/or consulting. In spite of efforts, however, producers were often unable to attend events due to the need for them to be focusing on their own farm needs (especially if the weather was conducive for various fieldwork needs), were cautious of adopting new practices that could possibly reduce their harvests (every bushel, bale, or pasture is needed), and/or were unable to purchase new equipment needed to incorporate best practices (e.g., no-

till drill). Many expressed interest or plans to incorporate advanced practices slowly. More details are noted in the Educational Approach Section.

Attachments:

[CLC--Field Day--Ag and Engery 8.26.22](#)

[CLC--NRCS Staff Ag 101 Training Evaluation 10.31.22](#)

[CLC--NRCS Staff Ag 101 Training Participation 11.3.22](#)

[CLC--Social media links](#)

[CSC--SARE Plot Plan](#)

[ICC--Career Showcase Flier 7.14.22](#)

[ICC--Career Showcase Postcard 7.14.22](#)

[ICC--Cargill Field Day 8.12](#)

[ICC--Soil Health Basics Training Checklist](#)

[ICC-Soil Kits Hosted By Sign](#)

[NDSCS--Field Day 6.30](#)

[NDSCS--Field Day 2022](#)

[NDSCS--Social media links](#)

[NECC--Videos--Soil Health Specifics](#)

[NICC--Field Days NICC--Media Releases](#)

[NICC--Surveys](#)

[NICC--Trainings_NICC](#)

[NTC--Agreement--Pheasants Forever 2020-2030](#)

[NTC--CE Course--Beginning Wine Making 2019](#)

[NTC--CE Course--Build My Future 2022](#)

[NTC--CE Course--Tractor Safety 2019](#)

[NTC--CE Course--Udder Clinic 2019](#)

[NTC--CE Course--WI Dairy Well-Being Roadshow 2019](#)

[NTC--Field Day--Cover Crops and Soil Health 2019](#)

[NTC--Field Day--Cover Crops and Soil Health 2021](#)

[NTC--Pollinator Plot](#)

[RCC--Soil Health Buckets](#)

[RCC--Soil Health](#)

[Y3--C2A3--2021 Annual Conference agenda](#)

[Y3--C2A3--2021 Annual Conference Schedule of Events](#)

[Y3--CLC AFREC Agenda 8.25-26.2021](#)

[Y3--CLC AGR Advisory Minutes 4.6.21](#)

[Y3--CLC AGR Advisory Minutes 11.3.2020](#)

[Y3--CLC Byron Team Meeting Notes 2.23.2021](#)
[Y3--CLC NRCS Field Tour Agenda 7.20.2021](#)
[Y3--NCC Advisory Committee Agenda 2.11.2021](#)
[Y3--NCC Advisory Committee Minutes 2.11.2021](#)
[Y3--NICC Advisory Committee Minutes--Ag Business 3.24.2021](#)
[Y3--NICC Advisory Committee Minutes--Ag Business 9.23.2021](#)
[Y3--NICC Advisory Committee Minutes--Agronomy & Crop Science 3.23.2021](#)
[Y3--NICC Advisory Committee Minutes--Agronomy & Crop Science 9.22.2021](#)
[Y3--NICC Field Day Agenda 9.16.2021](#)
[Y3--NICC Instructor Workshop Invitation 6.7.2021](#)
[Y3--NICC Instructor Workshop Agenda 6.7.2021](#)
[Y3--NICC Instructor Workshop Participants](#)
[Y3--NICC Instructor Workshop Post Survey](#)
[Y3--NICC Instructor Workshop Pre Survey](#)
[Y3--NTC Advisory Committee Minutes--Ag Sciences 5.12.2021](#)
[Y3--NTC Advisory Committee Minutes--Ag Sciences 10.15.2020](#)
[Y3--NTC Advisory Committee Minutes--Ag Sciences 12.14.2021](#)
[Y3--NTC Field Day Brochure 10.4.2021 Y3--NTC Field Day Save the Date 10.4.20211\)](#)
[Y2 Attachment--NICC Advisory Committee Agenda 9.22.2020](#)
[Y2 Attachment--NICC Advisory Committee Agenda 9.23.2020](#)
[Y2 Attachment--NICC Farm Visit Day 10.11.2019](#)
[Y2 Attachment--NICC Field Day Press Release 6.30.2020](#)
[Y2 Attachment--NICC YouTube](#)
[Y2 Attachment--NCC Advisory Committee Minutes 2.20.2020](#)
[9.30.19 Grant Kickoff and Annual C2A3 Meeting Agenda](#)
[C2A3 2019 Annual Conference Agenda](#)
[Clark State Ag Teacher Workshop 2019 Agenda \(1\)](#)
[Northeast Iowa College Field Day 2019 Agenda and Surveys](#)
[NTC Cover Crops and Field Day Flyer](#)
[NICC Soil Erosion and Soil Health Impact Module](#)
[Y4--CLC--Dairy Survey Template 8.22](#)
[Y4--CLC--NRCS MN Message Newsletter 5.22](#)
[Y4--CLC--NRCS Training Day Agenda 8.10.22](#)
[Y4--CLC--NRCS Training Day Agenda 11.3.22](#)
[Y4--CLC--Team Meeting Agenda 8.18.22](#)
[Y4--CLC--Team Meeting Notes 8.18.22](#)

[Y4--CSC--AGR Advisory Committee Agenda 10.24.22](#)
[Y4--CSC--AGR Advisory Committee Minutes 3.28.19](#)
[Y4--CSC--AGR Advisory Committee Minutes 4.2.20](#)
[Y4--CSC--AGR Advisory Committee Minutes 4.6.21](#)
[Y4--CSC--AGR Advisory Committee Minutes 10.3.19](#)
[Y4--CSC--AGR Advisory Committee Minutes 10.24.22](#)
[Y4--CSC--AGR Advisory Committee Minutes 11.2.21](#)
[Y4--CSC--AGR Advisory Committee Presentation 10.24.22](#)
[Y4--NDSCS--Ag Land Lab Advisory Committee Agenda 1.22.20](#)
[Y4--NDSCS--Ag Land Lab Advisory Committee Agenda 4.3.19](#)
[Y4--NDSCS--Ag Land Lab Advisory Committee Agenda 11.29.18](#)
[Y4--NICC--Agriculture Business Advisory Meeting Minutes](#)
[Y4--NTC--Ag Sciences Advisory Committ Agenda 12.14.21](#)
[Y4--NTC--Ag Sciences Advisory Committee Agenda 4.23.20](#)
[Y4--NTC--Ag Sciences Advisory Committee Agenda 4.26.22](#)
[Y4--NTC--Ag Sciences Advisory Committee Agenda 4.29.19](#)
[Y4--NTC--Ag Sciences Advisory Committee Agenda 5.12.21](#)
[Y4--NTC--Ag Sciences Advisory Committee Agenda 10.15.20](#)
[Y4--NTC--Ag Sciences Advisory Committee Agenda 12.5.19](#)
[Y4--NTC--Ag Sciences Advisory Committee Minutes 4.26.22](#)
[Y4--NTC--Ag Sciences Advisory Committee Minutes 4.29.19](#)
[Y4--NTC--Ag Sciences Advisory Committee Minutes 5.12.21](#)
[Y4--NTC--Ag Sciences Advisory Committee Minutes 10.15.20](#)
[Y4--NTC--Ag Sciences Advisory Committee Minutes 12.5.19](#)
[Y4--NTC--Ag Sciences Advisory Committee Minutes 12.14.21](#)
[Y4--RCC--Cover Crops Agenda Meeting Notice 8.2.19](#)

Project Objectives:

There are no project objective modifications needed at this time. The project's primary goal is to increase current and future producers' knowledge in soil health practices and help them adopt practices that are profitable, environmentally sound, and contribute to quality of life. Member colleges are actively reviewing available content from NRCS and other agencies, organizations, and higher education partners. The goal is to complement and enhance existing materials and curriculum, building in hands-on learning and supplementary activities.

PROJECT OUTCOMES:

Learning: 720 producers and 1,000 students will learn about techniques for establishing and managing sustainable soil health practices appropriate to their region such as monitoring soil health/qualities, reducing tillage, using cover crops for soil improvements, minimal/reduced/no-till systems, erosion control by using cover crops to keep soil armor, and water management tools-primarily through cover crops and soil structure/infiltration improvements; and more.

Action: 160 producers will better understand these practices and plan to implement one or more on their farm; 200 students will include practices in farm business plans and/or plan to implement.

Introduction:

The project's eight participating community/technical colleges are collaborating to advance agriculture and economic resiliency in rural Midwest communities through this grant and an existing partnership called Community College Alliance for Agriculture Advancement (C2A3). Project participants from 7 states include: Central Lakes College (MN), Clark State Community College (OH), Illinois Central College (IL), Northcentral Technical College (Lead--WI), North Dakota State College of Science (ND), Northeast Community College (NE), Northeast Iowa Community College (IA), and Richland Community College (IL).

This grant funded project facilitates the development of various soil health topics in preparation for training community/technical college students and regional producers to gain an understanding of sustainable soil health management practices. Community and technical colleges significantly impact the nation's agricultural workforce. These colleges yield over half of all U.S. graduates in higher education and serve as a pipeline for a substantial percentage of future agriculture producers, agribusiness professionals, and agriculture technicians. Community colleges excel at teaching students concrete examples of theoretical concepts, yet many producers fail to adopt practices into their farm management practices.

While there is a growing body of "innovative" farmers driven by taking risks and testing new ideas who are launching new soil health management practices with great success, most farmers (and the general population) are more risk averse, waiting for new ideas to be thoroughly tested before trying them out. There is a great need for tools and assistance to help these more cautious "middle adopters". This project aims to reduce this disparity by facilitating student and producer exposure to educational materials and demonstrations hosted by regional colleges.

Research

Involves research: No

Research conclusions:

Year 4/2022/Final: It is evident from the bullets below that while each college focused on soil health, the various soils, climates, crops, pests, and practices varied to best

impact their communities. Because of this variety, the breadth and depth of lessons learned were hot topics at Lunch n Learns, C2A3 conferences, and Advisory Council Zoom meetings.

Even though our project did not have a research intent, colleges did observe and conduct active research for various components of their projects. Below are examples.

- Solutions (what did you learn from the curriculum, field days, business partnerships?)
 - Central Lakes College (MN)-- Cover cropping and grazing can be a challenge in central MN where we have a short growing season. Establishing a cover crop following a commodity crop leaves little time for establishment and has not allowed for extensive biomass production. Grazing cattle following the establishment of cover crops after commodity crops also allows for only a short period of grazing before cold temperatures and snow become an issue. Bringing cattle in to graze can have real benefits on the soil health, increasing organic matter and microbial populations. Grazing cover crops could be more successful if planting corn in 60" rows on marginal ground and interseeding cover crops in the early growth stages of the corn. This does provide challenges to crop yield and pest control however. Kent Solberg developed extensive grazing management curriculum that was shared on the C2A3 Sharepoint site for use by all colleges in the consortia.
 - Clark State College (OH)--The applied research conducted focused on investigating the effects of cover crops on weed pressure, soil compaction, soil erosion, and corn yield. We used cereal rye, radishes, and either crimson or white clover. There were a few challenges; it was a newly tilled area and thus weed pressure was high throughout necessitating either more tillage or heavy reliance on herbicides (we opted for the former) and getting the cover crops planted on time due to harvesting issues (mechanical). No differences in soil compaction were observed, likely due to tillage. No yield differences were observed. There was negligible erosion observed and thus no differences. There were no differences in weed pressure observed until 2022 when it was discovered the field has an infestation of glyphosate-resistant horseweed. In 2022, the plots that had been planted with rye reduced weed cover early in the corn season (April/May), but by the end of May no difference could be observed. It was observed (not measured), that the "dump area" (where the planter was emptied of cover crop seeds) seemed to have the best density of cover crops. Thus, in fall of 2022 a mix of all three species was planted and we hope to move forward with that based on our future observations. It should also be noted that this field was used extensively for several courses including soil science, weed science, and crop production.
 - North Dakota State College of Science (ND)--Our demonstration plots are meant to be just that, demonstrations. These demonstrations were conducted to show students visual differences in soils due to different practices. Each plot was managed similarly except for tillage practice and cover crop use. Each year plots received the same inputs. Soil observations, yield comparisons, weed density differences were monitored for each plot. We also

did work with NRCS to collect some qualitative data on soil differences between the demonstration plots.

- Northeast Iowa Community College (IA)—Employers are excited we have incorporated livestock nutrient management into all of our agriculture and animal science education plans. The addition of soil health components has had a positive impact on the employability of our graduates and has increased the ability of graduates to better manage nutrients on their farms and assist other producers with management of their farms. We have also developed a soil health lab class that we are incorporating into our new "Conservation Agronomy" Program. This course will not be taught until next year as it is in the second year of the new program. -- Our field days have been very successful. Our post program surveys indicated that more producers plan to incorporate cover crops into their operations and those who already utilized cover crops learned best practices from our NICC farm's use of cover crops and cocktail cover crop mixes. We also illustrated the progress of our NICC farm's improvement to soil health through soil sample testing over the past three years. This information was shared at annual C2A3 conferences and made available to nine other cooperating community colleges in eight other states. -- The NE Iowa Dairy and Agriculture Foundation has been very supportive of all our soil health demonstrations on our farmland and have seen great results from utilizing cocktail mix by ensiling the green cutting and feeding it to their beef and dairy herds. They are excited at the prospect of creating a level of soil health that could lead to the need for less fertilizer.
- Richland Community College--We collaborated with Western Illinois University to plant a Pennycress cover crop on the RCC campus. Western Illinois University provided the seed and equipment for planting of pennycress plot. Plot preparation (tillage, fertilization, herbicide application) and other tasks were completed by RCC. It was valuable to be exposed to a potentially emerging cover crop, but primarily we learned firsthand regarding the limitations or negatives of the newly researched crop. The intent of the research was to determine the viability of Pennycress as a cover crop.
- Results and discussions
 - Central Lakes College (MN)--When cattle were integrated into the system, there was a direct correlation to soil microbial activity and organic matter on years where large groups of cattle could be integrated for a long period of time (4 weeks or more). In order to provide cattle producers a worthwhile grazing opportunity, short season crops such as potatoes or kidney beans need to be planted to allow time to establish a cover crop prior to freezing after harvest of these crops. Soil health was measured using the Haney and PLFA tests. See attached results.
 - Clark State College (OH)--Prior to this grant, we did not have an agricultural field/land lab. We know covering theory/lecture material and then immediately following it up with lab and/or hands-on activities is a very effective method for learning; we were not as able to do this prior to this grant. We learned that even the students themselves appreciate this approach and benefit from being able to actually see and do things. Also, participating in this grant and working with

C2A3, we learned things and ideas from colleagues, in particular about soil health. We made it a point to emphasize conservation practices and the importance of soil health in our curricula. Some of our students come from family farms and often state how amazed they are at the changes made over just the past twenty years in regards to soil conservation and health. The implication here being that hearing it from the farmers/land managers themselves seems to be quite impactful. Asking students to research and propose solutions to grand challenges as it regards soils also appears to be an engaging and impactful learning tool. As of fall 2022, soil science students are now required to do that in the soil science course. Observations are preliminary, but it appears to have been successful.

- North Dakota State College of Science (ND)--To this point, both the no till/cover crop plot and the conventional plot have only differed based on those two practices; all other inputs have been identical. This was deemed necessary as this was the first attempt of any kind on this heavy clay field being put into a conservation practice, and particularly no till. We will continue with this demonstration even following the conclusion of this grant. Still, financial implications of total project were determined along the way. It is our view that farmer adoption of a new practice must show economic benefit to make it happen.
- Northeast Community College (NE)-- Although the initial research area for the SARE grant did have to be relocated because of a capital construction campaign providing new agriculture facilities at NECC, data was able to be collected for the new site. All data collected will be accessible via the C2A3 website. Soil samples, manure samples, cover crop mix data, and others will be available for other instructors to be able to utilize.
- Northeast Iowa Community College (IA)--As a result of our applied research (which continues with the consortium NRCS grant) and demonstrations, we have shown that NE Iowa dairy and beef farms can reduce erosion, improve water quality, and significantly increase their soil health because we have the soil test data to back it up.
- Northcentral Technical College (WI)--During the time of our testing, lime was not part of our study, so soil pH has dropped since the beginning of this grant. Cover crops, when applied properly, do suppress weeds and thus reduce chemical applications of herbicides. Through our uses of cover crop and manure management practices, we have successfully reduced phosphorous levels from excessively high to optimum levels.
- Richland Community College (IL)--RCC was happy to host 21 farmers from throughout our district and beyond who attended the "Cover Crop Choices" event that we held with the Prairie Beef Association. This cover crop event was the first exposure to cover crops for many of the producers but the response was very positive. For our first joint event we were very happy with the attendance and feedback. In addition, it should prove to be a first step in the continuation of a partnership on future training events as well.

Participation Summary

Education

Educational approach:

This project is facilitating the development of various soil health topics in preparation for training community/technical college students and regional producers to gain an understanding of sustainable soil health management practices. While there is a growing body of “innovative” farmers driven by taking risks and testing new ideas who are launching new soil health management practices with great success, most farmers (and the general population) are more risk averse, waiting for new ideas to be thoroughly tested before trying them out. There is a great need for tools and assistance to help these more cautious “middle adopters”. This project plans to reduce this disparity by facilitating student and producer exposure to educational materials and demonstrations hosted by regional colleges. Topic areas, some regionally-specific and some applicable to multiple colleges, include: Carbon Storage, Compaction, Fertilizer Retention, Manure Management, Physical/Biological Improvements, Soil Erosion, Soil Microbial Health, Water Management, Water Quality, and Weed Resistance.

The project’s primary goal is to increase current and future producers’ knowledge in soil health practices and help them adopt practices that are profitable, environmentally sound, and contribute to quality of life. Member colleges are actively reviewing available content from NRCS and other agencies, organizations, and higher education partners. The goal is to complement and enhance existing materials and curriculum, building in hands-on learning and supplementary activities. Several methods, educational strategies, and inputs will be used to carry out the project. Year 1 of the project has included:

- Year 1: Individual colleges have hosted advisory panels at least once/year.
- Year 1: The “broad thread” curriculum; i.e., soil health, cover crops and no till agriculture, is being built from existing content from additional potential postsecondary educational partners and purchasing and customizing tools available from the USDA Natural Resources Conservation Service—specifically the use of soil health test buckets with soil quality test kit exercises to help implement soils curriculum in the field and/or classroom at individual colleges.

Colleges are making extensive use of new courses/curriculum put in place in year 1 of the project to increase student knowledge of sustainable agricultural and conservation practices. Students have been and will continue to be involved in the field days where information learned will be shared with producers from their area. Curriculum development and implementation will continue into the second year of the project. In project years 2 and 3, colleges will integrate curriculum materials such as learning modules and lesson plans within current agricultural courses, ultimately serving 1,000 community/technical college students.

Year 2/2020 UPDATE:

- Adjusting to the impact that COVID-19 had on face-to-face learning/labs/Field Days due to social distancing and safety precautions. This included adjusting curriculum, moving lab demonstrations to virtual and/or video mediums, decreasing face-to-face class sizes, incorporating technology to develop mini-videos for curriculum/Field Days/outreach, and using the work-from-home time to focus on modifying curriculum with new strategies, action research opportunities, and Soil Quality Health Bucket activities.
- A broader sharing of newly developed/modified curriculum with consortium members for adoption, integration, or awareness. This included faculty sharing how they adapted courses, lectures, and labs due to the COVID-19 pandemic, how they continued to engage producers and partners, and how they were planning to work through the remainder of the pandemic with both face-to-face and virtual instruction/learning.
- Greater partner involvement to ensure non-duplication of effort and increase resources for product and services. This engagement has increased/enhanced the relationships between the college and local/state NRCS staff, thus increasing the impact across seven Midwestern states.

Year 3/2021 UPDATE:

- Continued to implement COVID-19 protocols, thus adjusting face-to-face learning/labs/Field Days due to social distancing and safety precautions. This included adjusting curriculum, moving lab demonstrations to virtual and/or video mediums, decreasing face-to-face class sizes, incorporating technology to develop mini-videos for curriculum/Field Days/outreach, and using the work-from-home time to focus on modifying curriculum with new strategies, action research opportunities, and Soil Quality Health Bucket activities.
- Continued sharing of newly developed/modified curriculum with consortium members for adoption, integration, or awareness. This included faculty sharing how they adapted courses, lectures, and labs due to the COVID-19 pandemic, how they continued to engage producers and partners, and how they were planning to work through the remainder of the pandemic with both face-to-face and virtual instruction/learning. C2A3 Lunch & Learn presentations provided opportunity to share promising practices, get information on college projects, etc.
- Greater partner involvement to ensure non-duplication of effort and increase resources for product and services, specifically state NRCS, thus increasing the impact across seven Midwestern states.

Year 4/2022/Final

- Central Lakes College—Field tours and discussions.

- Clark State Community College: Soil health buckets used in soil science course and demonstrated in field.
- North Dakota State College of Science--Our primary focus over the duration of the project has been with students through agriculture courses and summer field days. We have exposed many students to soil health practices over the duration of this project and will continue to do so after project completion. We feel this will be impactful as students return to the farm or take employment. Soil health buckets were a key component to provide students with opportunities to learn about soil properties and the effect of soil health practices on those properties. We purchased three buckets with grant monies as well as purchased additional supplies to provide enough supplies to have several student groups perform the measurements.
- Northeast Community College-- In 2020, NECC introduced an Associate's Degree in Natural Resources to assist in alleviating pressure USDA is facing with filling empty positions. This degree has already resulted in five graduates, with many more high school and college students interested in the degree. -- NECC faculty have taken a team approach in making sure each course offered has sustainable and regenerative practices and management style adopted into the courses. -- Faculty developed a large Field Day (open to students, producers, FFA chapters, faculty, and school administration) to showcase applied research being conducted at NECC's Acklie Family Farm; the field days in 2021 and 2022 were well received and plans are to continue them on an annual basis.
- Northeast Iowa Community College--This project design supported NICC in developing curriculum that covers soil health topics such as manure management and soil erosion that is included in community college classes. The material has been introduced to regional producers to provide an understanding of sustainable soil health management practices. There is a great need for tools and assistance to help more cautious "middle adopters" adopt new practices. This project is reducing this disparity by facilitating student and producer exposure to educational materials and demonstrations hosted by NICC. -- Manure management: Historically manure application has been looked at mainly as just a waste product that we need to get rid of. Producers are starting to become more aware of the importance of manure and its impact on soil health, crop production, and the environment. The correct application of manure can have a direct positive impact on soil health although too much manure can cause an adverse effect on soil health and the environment. Northeast Iowa Community College's Livestock Nutrient Management (AGA 159) class covers nutrient values, application rates, and techniques.
Soil Erosion: This topic is specific to regions located in a heavy livestock area made up primarily of beef and dairy cattle. Historically the reason for the heavy cattle presence is because of hilly ground and the need of hay or pasture in the rotation. With increasing concentrations of cattle, producers are now relying more on chopped corn silage which provides more feed per acre and less reliance on pasture and hay. New cropping practices leaves the ground with little residue in the fall and susceptible to erosion. If the erosion is not managed the environment and long term productivity of the soils will suffer. Soil aggregate stability is a big component of soil health. Controlling soil erosion has a direct positive impact on

soil aggregate stability and soil health. NICC developed curriculum related to soil health and erosion including but limited to compaction, fertilizer retention, water and wind erosion, and soil biology and sustainable soil practices. We have utilized curriculum from the "Soil Health Buckets" in training of area high school agriculture instructors who are now exposing K-12 students to the importance of soil health. – The Principles of Agronomy (AGA 114) class includes 5 labs using the soil health bucket. During the grant period, this class has been offered three times: Fall 2020, 2021 and 2022. – NICC developed instructional materials that include the soil quality test bucket for the NICC Summer Agriculture Instructor Faculty Workshop (Summer 2021).

- Northcentral Technical College—soil pit; Star Environmental; Build My Future; Dual Credit Days soil pits; rainfall simulators; class planted cover crops, grapes and apple trees; pollinator plot; tapping maple trees; soil sampling; tissue analysis; students assisted with tours; K-12 tours.
- Richland Community College—The project facilitated the development of various soil health resources for use in the training of community college students and regional producers to gain an understanding of sustainable soil health management practices. While there is a growing body of “innovative” farmers driven by taking risks and testing new ideas who are launching new soil health management practices with great success – most farmers (and the general population) are more risk averse, waiting for new ideas to be thoroughly tested before trying them out. There is a great need for tools and assistance to help these more cautious “middle adopters” adopt new practices. The project was designed to reduce this disparity by facilitating student and producer exposure to educational materials and demonstrations. RCC hosted a soil health bucket training in June 2019 which was presented by Western Illinois University Soil Science instructor – Dr. Joel Gruver. Forty agricultural instructors from throughout Illinois attended the professional development. As a result of the training, we have not only utilized the soil health bucket activities within our Agriculture courses, but also demonstrated activities in high school agriculture course presentations.

Project Activities

[Central Lakes College: Adding cover crops to row crops and graze area for 30 days each fall](#)

[Central Lakes College: 2019 Integrating cover crops into conventional row crop rotations with seasonal livestock grazing](#)

[Illinois Central College: Wetland Field Day](#)

[Northcentral Technical College: Field Day 2018](#)

[Northcentral Technical College: Field Day 2019](#)

[Northcentral Technical College: Marathon County June Dairy Breakfast \(host\)](#)

[Northeast Iowa Community College: Field Day](#)

[Richland Community College: Cover Crop Choices: Utilizing Cover Crops and Alternative Forage Crops for Livestock Feed](#)

[Central Lakes College: Field Day 2020](#)

[Central Lakes College: C2A3 Annual Meeting/Conference](#)

[Northeast Iowa Community College: Norman Borlaug Heritage Farm Visit Day](#)

[Northeast Iowa Community College: Virtual Farm Day 2020](#)

[NDSCS: Field Day 2020](#)

[C2A3 Annual Conference](#)

[NICC Summer Agriculture Instructor Faculty Workshop](#)

[ICC Bi-State Soil Health Training](#)

[NRCS Field Day Training](#)

[AFREC Field Tour](#)

[Summer Intern Field Days](#)

[Tri-State Ag & Dairy Expo](#)

[Acklie Family Farm Field Day](#)

☐ Educational & Outreach Activities

62 Consultations

44 Curricula, factsheets or educational tools

25 On-farm demonstrations

8 Online trainings

13 Published press articles, newsletters

89 Tours

47 Webinars / talks / presentations

27 Workshop field days

65 Other educational activities: Curriculum incorporated into courses; K-12 Student Events; Public Events

Participation Summary:

569 Farmers participated

653 Ag professionals participated

Education/outreach description:

Year 2/2020 UPDATE: 197 students (duplicated) participated in learning activities.

Year 3/2021 UPDATE: 289 students (duplicated) participated in learning activities.

Year 4/2022/Final: 3,307 students (duplicated) participated in learning activities.

Central Lakes College: Outreach is a combination of those who attend field days and workshops. We also publish an annual report that provides a project overview –

we hand out about 300 hard copies as well as several soft copies. Year 2/2020 UPDATE: No events/field days held due to COVID-19. Year 3/2021 UPDATE: CLC hosted the C2A3 Annual Conference, September 19-21, 2021 (40 participants; C2A3 members expressed great interest in CLC projects and were able to take some ideas back for their programs; the meeting brought one of our first real rains after an extremely long summer drought!). CLC submitted an Annual Ag & Energy Center Report in February 2021. Kent Solberg presented grazing curriculum at C2A3 Annual Conference. NRCS Field Day Training, July 20, 2021 (18 participants); AFREC Field Tour, August 25-26, 2021 (30 participants); CLC Annual Field Day, August 27, 2021 (Byron Study was highlighted during lunch program).

Clark State Community College:

- Ohio State FFA Convention, May 1 -3, 2019
- Participated in local food/ag workgroup on 9/24/19, 11/20/19 and 1/9/20 on how to further agriculture and the food industry locally. Conference Meeting with Chris Simpson, District Administrator Clark, Soil & Water Conservation District; William Cook, Resource Conservationist Clark and Madison Counties, NRCS; and Jerome Best, Clark County NRCS
- Conference Meeting with NCRS State, Regional, and Local representatives, February 5, 2019. Seven attended including: Tatrechia Davis, Assistant State Conservationist for Special Projects; Chris Simpson, District Administrator, Clark Soil & Water Conservation District; and Roderick Kuykendall, NRCS Assistant State Conservationist – Filed Operations Southwest Ohio – Area 4
- Conference Meeting with NCRS State, Regional, and Local representatives, March 7, 2019. Seven attended including: Tatrechia Davis, Assistant State Conservationist for Special Projects; Chris Simpson, District Administrator, Clark Soil & Water Conservation District; and Roderick Kuykendall, NRCS Assistant State Conservationist – Filed Operations Southwest Ohio – Area 4
- Met with local precision ag company to establish relationship with college and discuss potential ways to integrate a soil moisture into proprietary algorithm to reduce soil compaction on 12/5/19
- Year 2/2020 UPDATE: No events/field days held due to COVID-19.
- Year 3/2021 UPDATE: CSC: AGR 1300 (Soil Science); AGR 1750 (Precision Agriculture); AGR 2200 (Crop Production); AGR 2601 (Weed Science). COVID-19 is still presenting some challenges, particularly hosting a field day.

Illinois Central College: The Wetland Field Day had several tour stops for education as well as several articles in popular press including the September issue of Prairie Farmer magazine. Year 2/2020 UPDATE: No events/field days held due to COVID-19. Year 3/2021 UPDATE: Bi-State Soil Health Training (20 participants).

North Dakota State College:

- Jr Crop Scout School 4H – August 13
- RDO training event on June 25th-27th – they used field trials for their event

- Red River Valley Watershed tour – they stopped to see cover crop field trials
- Used the demonstration plots in various classes in fall semester – Introduction to soils, Principles of crop production/Introduction to precision agriculture – labs in various classes used the field for many activities. Approximately 80 students attended the various labs at different times over the semester
- Year 2/2020 UPDATE: Held a Field Day on June 30, 2020; students and the public were invited; 33 participants.
- Year 3/2021 UPDATE: Posts on Facebook and Twitter. NDSCS uses land lab videos, photos, and other visuals for college recruiting events throughout the year. Craig Zimprich, Agriculture Department Chair, presented information on the land lab as part of a North Dakota State Board meeting on September 15, 2021. Summer Intern Field Day, May 25, 2021 (36 students); Summer Intern Field Day, June 15, 2021 (33 students); Summer Intern Field Day, June 15, 2021 (40 adults); Summer Intern Field Day, June 29, 2021 (22 students).
- Year 4/2022/Final: Several ag professionals participated in field days; many were from partner groups we had for field days, Jr. Crop Scout School 4H, 8/13/2019; RDO training event, 6/25-27/2019; NDSCS Career Awareness Seminar, 6/11-12/2019 and 6/15-16/2021

Northcentral Technical College: D.C. Everest Action Adventure Day Group- Students participate in on farm tours and various activities; 2018 Soil Health Field Day; Food for America- 4th graders and high school students participate in on farm tours and educational stations; Battle Lake FFA- tour & demonstration; Stratford High School Students- tour & demonstration; Lincoln Elementary After School Program – tour & demonstration Cloverbuds 4-H- tour & presentation; Agriculture Dual Credit Student Day- High school students tour and participate in various educational activities; Tour D.C. Everest 9th grade Agriculture students Career in Action Day- Abbotsford- High school students tour and participate in various educational activities; Career in Action Day- Mosinee- High school students tour and participate in various educational activities; Agco Equipment Training Group; Aurora Vocational School- Students tour and participate in various educational activities; Mosinee Career in Action Students & Instructor- High school students tour and participate in various educational activities; Tour African Farmer & Author- Tour Edgar HS Dual Credit Ag Class; Dual Credit Day Merrill & Wausau East High Schools- High school students tour and participate in various educational activities; Hosted June Dairy Breakfast- Tours and numerous activities and events for attendee's to participate in Rib Lake, Abbotsford and Athens Summer School- High school students tour and participate in various educational activities; Tour St. Michael School; Presidential Leadership Summer Camp- Students tour and participate in various educational activities; Tour Boys and Girls Club; Career Camp Summer Students tour and participate in various educational activities; Food For America -4th graders and high school students participate in on farm tours and educational stations; Fall Agriculture Dual Credit Day High school students tour and participate in various educational activities; 2019 Cover Crops and Soil Health Field Day; D.C. Everest Action Adventure Day Group- High school students tour and participate in various educational activities. Year 2/2020 UPDATE: No events/field days held due to COVID-19. Year 3/2021 UPDATE:

Field Day in October 2021. Year 4/2022/Final: School of Ag Sciences, Utilities and Transportation Job & Transfer fair; State PAS; Farm City Dinner; Mosinee Career in Action day (20 students); Bowler Career in Action Day (20 students); Spencer High School visit; National PAS; College Exploration Day; Mosinee High School job shadow farm staff; Spring Dual Credit (98 students); Boys & Girls club exploration series (10 students); June Dairy breakfast at Walters farm; Wausau Campus summer camp (40 students); Farm Technology Days; Presidential Leadership camp (10 students); WI Agriculture, Trade and Consumer Protection Secretary Romanski visit; C2A3 conference in Ohio; Build My Future event (800 students); Wausau West FFA Food for America; DPI Ag Teacher in service (40 teachers); PAS Pumpkin Painting; Central Lakes College event; Swiderski Ag Technology event; Fall Dual Credit day (76 students); beekeeping training.

Northeast Community College: *K12 events (e.g., summer camp, dual credit courses):*

At the 2019 Career Fair that took place at Northeast, I spoke to five students in the 10th grade on sustainable practices within agriculture. As part of our participation in the career fair, the soil books and tables that were purchased with grant funds were put to good use. *Media events (e.g., ribbon cutting, press release):* The publication office at Northeast Community College printed a story and sent to the Norfolk Daily News, along with posting it on Facebook, about the College's new Natural Resource degree program. In addition to its print version, the Daily News also posted the story on its website. Via Facebook, the information reached 2,427 individuals, including 96 clicks to the link, as well as 58 comments and "likes." The degree program, which came about, in part, because of discussions involving the C2A3 consortium, is not funded by the SARE grant but stands as a major accomplishment for Northeast. Here is the URL for the article from the Northeast website:

<https://northeast.edu/News/Article.aspx?ID=3357>. Year 2/2020 UPDATE: No events/field days held due to COVID-19. Year 3/2021 UPDATE: NCC Field Day, September 2021. Acklie Family Farm Field Day, September 1, 2021; press release/Facebook posts were issued relating to the field day.

Northeast Iowa Community College: In Year 1, NICC partnered with the Norman Borlaug Foundation for a Fall Field Day. Hosted at the Foundation's Farm, the day's agenda included presentations on erosion, drones, water quality and soil health, and grazing management.

As part of a Calmar Campus Operations project, the College received a Silos & Smokestacks National Heritage Area grant to develop and install interpretive signs highlighting College efforts to improve its ecological footprint. One of the signs focuses on soil health – particularly highlighting the importance of manure management and cover crops, and the C2A3 consortium is recognized. Year 2/2020 UPDATE: NICC held two Advisory Committee meetings, a face-to-face Field Day (10/11/2019) with 14 students, and a virtual Field Day (6/30/2020) with 20 participants. Year 3/2021 UPDATE: AGA114 Principles of Agronomy (Fall 2020/Fall 2021); AGA159 Livestock Nutrient Management (Fall 2020/Fall 2021). NICC Summer Agriculture Instructor Faculty Workshop (11 participants). 2 Soil Health Coffee Talks (virtual field day events). Tri-State Ag & Dairy Expo (550 FFA students and advisors from Iowa, Minnesota, and Wisconsin as well as producers, industry members and college students). Year 4/2022/Final:

- In 2019, NICC partnered with the Norman Borlaug Foundation for a Fall Field Day (October 11). Hosted at the Foundation's Farm, the day's agenda included presentations on erosion, drones, water quality and soil health, and grazing management. -- In 2020, NICC hosted a virtual field day (June 30) focused on soil health in partnership with the Northeast Iowa Dairy Foundation and the local NRCS office. The webinar was recorded and posted on the NICC Agriculture YouTube page and has continued to received views. -- In 2021, NICC made an effort to diversify its outreach efforts. First, NICC and its partners published two Soil Health Coffee Talks (mini virtual field days) on the Iowa Dairy Center YouTube page. -- The College also held a workshop for agriculture instructors who teach in secondary schools. For this workshop NICC faculty broke down the manure management curriculum into curriculum packets and provided soil health buckets to help the teachers incorporate the material in their own classrooms. -- Finally, in October 2021, NICC partnered with the Northeast Iowa Dairy & Agriculture Foundation and Iowa State University Extension and Outreach to host the Tri-State Ag & Dairy Expo at Iowa's Dairy Center. This event enabled NICC to broadly expand its reach to 550 FFA students and advisors from Iowa, Minnesota and Wisconsin, as well as area producers, industry members and college students. The SARE topic, "Cover Crops Result in Healthier Cows, Healthier Soils and Cleaner Water" was presented by Agriculture Instructor Brodie Bushman.

Richland Community College:

- Farm Progress Show – Richland Community College Tent
- Cover Crops Choices Field Day with Prairie Beef Association
- Illinois high school agriculture teachers professional development – Soil Health Buckets
- Illinois high school agriculture teachers professional development – Soil Evaluation
- Year 2/2020 Update: Planned a Field Day in collaboration with Macon County Soil and Water Conservation; not held due to COVID-19.
- Year 3/2021 UPDATE: Continued to adjust to challenges of COVID-19 and the pandemic.
- Year 4/2022/Final: 40 professionals at Soil Health Bucket Training (June 2019); 75 Illinois high school agriculture teachers at Soil Evaluation Training. 74 students enrolled in RCC ag courses. The course content and labs were modified as a result of this initiative to increase the emphasis on soil health best management practices. Farm Progress Show (2019 and 2021), RCC Tent; Crop Crops Choices Field Day with Prairie Beef Association; Illinois high school agriculture teachers professional development – Soil Health Buckets; Illinois high school agriculture teachers professional development – Soil Evaluation; Macon County Soil and Water Conservation District Annual Meeting; RCC agriculture staff wrote articles for the Macon County Soil and Water

Conservation District newsletter regarding our program and efforts related to soil health.

Learning Outcomes

33 Farmers reported changes in knowledge, attitudes, skills and/or awareness as a result of their participation

131 Agricultural service providers reported changes in knowledge, skills, and/or attitudes as a result of their participation

Key areas taught:

- Soil Health Evaluation and Improvement
- Operational knowledge of cattle integration
- cover crop germination
- crop residue management
- review of feed savings due to available biomass on project fields
- Precision Agriculture
- Intro to Natural Resources
- Agroecology
- Farm Equipment Technology to help farm management
- Rainfall Impact on Heavy Tilled Soils
- Using Drones to Manage Soil Resources
- Proper Livestock Care for Sustainability
- Cropping Systems, Soil Health Practices
- Soil Pit, Salinity and Valley Soil Issues
- Weed Identification
- Using Drones to Observe Farm Practices
- Water Quality & Soil Health
- Rainfall Simulator
- Animal Nutrition and Grazing Management
- Precision Mapping/GPS Mapping
- Cover Crop Basics
- Soil Health on Marginal Soils
- John Deere technology
- Impact of rainfall on heavy tilled soils
- Impact of different plants on soils

- Balancing an Ag Economy with Clean Water and a Healthy Environment
- The Root Project
- The Hidden Half of Nature
- Weed Suppression, Erosion Control, Grazing, Carbon Sequestration, Soil Health
- Measuring Biomass, GDD's, Growth Rates & Other Observations
- Planting Green/Planting into High Residue

☐ Project Outcomes

4 Farmers changed or adopted a practice

Key practices changed:

- Increase awareness and interest in the use of cover crops.
- Incorporating cover crops into operation.
- Soil health
- No till

9 Grants applied for that built upon this project

4 Grants received that built upon this project

12 New working collaborations

Success stories:

Central Lakes College: Strengthened relationships with the farmers involved as well as land owners. Added a new perspective to this work: area of the feed savings for the livestock producer so we can potentially educate farmers about charging livestock owners to recover costs of cover crop planting. Initial work in this area is looking promising.

Clark State Community College: Confidence in identifying a reasonable method of accounting for soil moisture in the algorithm, which should reduce soil compaction by keeping equipment out of fields until moisture levels are appropriate for bearing load.

Illinois Central College: Spoken at 5 different farmer meetings and 2 agency meetings reaching about 350 people on herbicide issues and cover crops. Many of the agency and industry representatives use our publications as handouts to their own clientele so I am sure the total number reached by our research is in the thousands. In addition to speaking at meetings, I get on average about 5 calls per month directly from producers asking questions on the work we are doing here at ICC and advice on growing cover crops on their own farms. Teleconferenced with a farmer who is in the process of turning their farm to organic production, discussed soil health, water quality, cover crops etc. Their farm is about 30 miles from ICC, and they want to start working with

us as their farm transitions. They even would like agriculture students to be involved in this process for the teaching/learning aspect that this could provide.

Richland Community College: A beef producer from central Illinois greatly appreciated the opportunity to hear from producers with significant experience and expertise on cover crops. As a result, he will be incorporating the use of cover crops into his operation.

Year 3/2021 UPDATE:

Central Lakes College: With the drought conditions experienced in Spring 2021 and having fall seeded cover crops such as rye, we were able to capitalize on a grazing opportunity for livestock. Many pastures near this project area never received enough moisture to be used for livestock grazing, creating a huge deficit of both grazing acres and hay volume. If we can continue to work with cover crops within different cropping rotations and spread out the grazing potential to multiple different timeframes, we can support livestock for a longer period of time, while still working to improve soil health. We had an excellent Fall that allowed the early planted cover crop to grow very well. With a shortage of forage produced this summer, our cattle producers have reduced herd numbers and are looking for any source of forage possible; the cover crop will help producers save some hay.

Illinois Central College: The project has become multidisciplinary as the science department has been working with the ag department. A lot of state and federal attention has been given to the work the College is doing.

North Dakota State College of Science: This grant has provided a great opportunity to develop relationships with other two-year colleges, allowing us to learn from and with one another. For our students, we believe it has provided a great opportunity to actively engage in soil health practices, collect data, draw potential conclusions, use precision agriculture concepts and practices. We also have used this project to partner with the NDSCS Diesel department. The diesel students have assisted with equipment repairs and have been able to have learning experiences with tillage, some cover crop planting, cutting and baling and other practices.

Northeast Iowa Community College: Even though there has been challenges with COVID restrictions, the SARE grant has been a good opportunity to create partnerships and formulate plans for the upcoming academic year, as well as develop new ways to reach out to our community. The high school instructor workshop has helped expand the NICC reach beyond its immediate student group and build bridges to encourage interest in the agricultural field in secondary students. This opportunity has pushed NICC to expand our reach beyond the campus classroom.

Richland Community College: RCC is very appreciative of the grant and the opportunity to collaborate with other colleges from throughout the Midwest. The sharing of knowledge that has occurred via this grant has been very beneficial to our educational efforts related to soil science, soil health, and regenerative agriculture. We were unable to do field days due to the pandemic, but students benefit from the RCC Agriculture staff sharing the practical knowledge that they gained through this initiative.

Year 4/2022/Final:

- Illinois Community College--ICC is a founding member of the Illinois Sustainable Health Partnership (ISAP). ISAP has its own website, Board of Directors, and does many meetings each year. <https://ilsustainableag.org/>
- North Dakota State College of Science--Anecdotal comments by students over the project years indicate an appreciation for soil demonstration observations that were right at hand given students were continually out in the plots. Over the years, students commented that getting to see these practices in action have provided them with knowledge on how some soil health practices can be used. The drawback to adopting practices has tended to be that they are not the decision maker on their farm, the high cost of production and in some years lower commodity prices, and an uneasiness of risk and change in management practices.
- Northcentral Technical College--This project spearheaded the expansion of collaborations, programs, and demonstration plots at our Agriculture Center of Excellence. Growth includes a pollinator plot, small apple and grape orchard, Pheasants Forever partnership, maple tree sap collection and syrup making, and a robust collaboration with Wisconsin's NRCS team.
- Northeast Iowa Community College--NICC is proud to be developing a greater awareness of how to take care of our land and soil which leads to increased profitability and better environmental stewardship. Furthermore, this opportunity has pushed NICC to expand our reach beyond the campus classroom and provide or participate in events and workshops that include secondary teachers and students.
- Richland Community College--As a result of a field day, a beef producer from central Illinois greatly appreciated the opportunity to hear from producers with significant experience and expertise on cover crops; as a result, he will be incorporating the use of cover crops into his operation. RCC was proud to host more than 100 Illinois agriculture teachers as they attended professional development workshops related to soil science; the teachers received valuable hands-on training in multiple soil pits on-campus which will be valuable to their classroom instruction related to soil science; in addition, teachers received a free soil health bucket and the training necessary to replicate the engaging labs and activities. RCC is excited about developing a partnership between our Agricultural Program and the Macon County Soil and Water Conservation District to collaborate on educational programs and field days such as the strip till field day; we believe that both of us will benefit by coordinating of efforts and the synergies developed would not have occurred without our involvement in this SARE grant initiative. Developed a twenty hours per week internship for an RCC Agriculture student at the Macon County Soil and Water Conservation District. RCC hosts the Farm Progress Show every other year on our campus; we met with Farm Progress Show staff a multiple times to discuss options for highlighting the use of cover crops as part of the show; it is an opportunity to reach a large number of producers and others in involved in agriculture to build their knowledge and understanding of cover crops role in building soil health.

Recommendations:

Some colleges have inquired about additional SARE signage to display during events.

Year 3/2021 UPDATE:

- As our project comes to fruition in 2022, we will be watchful for possible suggestions and recommendations that could be shared with SARE. Current health restrictions have been difficult to work with, but new ideas (such as virtual field days) are being implemented.

Year 4/2022/Final:

- North Dakota State College of Science--We have received a great deal of assistance from partners that encourage us to continue with this demonstration. We have been fortunate to find opportunity to bring additional soil health expertise through various guest speakers from NDSU, other farmers in the area using various soil health practices, and professionals from soil and water conservation districts both in ND and MN. We continue to see the need to continue these demonstrations and experiences in soil health practices for our students.
- Consortia--Find ways to measure impact on producers (e.g., surveys, producer groups) and agriculture graduates (e.g., surveys, reunions).
- Consortia--Continue to identify ways to collaborate with state NRCS partners. Many of the colleges have formed an MOU with their NRCS teams for student internships, NRCS personnel training, and joint presentations at field day events.
- Consortia--C2A3 wants to continue collaborations on joint projects focused on specific agriculture initiatives. We know the value our consortia can bring to active research is significant as we incorporate best practices across the Midwest. Our impact is just beginning!

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture or SARE.



This site is maintained by SARE Outreach for the SARE program and is based upon work supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award No. 2021-38640-34723. SARE Outreach operates under cooperative agreements with the University of Maryland to develop and disseminate information about sustainable agriculture. *USDA is an equal opportunity provider and employer.*

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