

**Project Name:** Menoken Farm Planting Green Project  
**Reporting Period:** Final report for Aug. 1, 2018, through June 30, 2022  
**Project Period:** Aug. 1, 2018, to June 30, 2022  
**Project Status:** Complete

**Total Project Expenditures to Date:**

Table 1. Total Section 319 Grant Awards as of June 30, 2022

|                          |                   |
|--------------------------|-------------------|
| FY17 Section 319 Funding | \$ 50,000         |
| FY18 Section 319 Funding | \$165,000         |
| <b>Total</b>             | <b>\$215,000*</b> |

*\*As of 6/30/22, 100% of the Section 319 funds had been expended*

Table 2. Cumulative Project Expenditures – Aug. 1, 2018, through June 30, 2022

|                        |                     |
|------------------------|---------------------|
| Personnel              | \$ 49,816.44        |
| Fringe benefits        | .00                 |
| Travel, food & lodging | 712.59              |
| Supplies               | 117,026.57          |
| Rent/utilities         | 8,186.00            |
| Communications         | 747.98              |
| Equipment              | 750.00              |
| Consultant/contractual | 20,880.53           |
| Other                  | 16,880.08           |
| Administration         | 0.00                |
| Match                  | <u>143,333.47</u>   |
| <b>Total</b>           | <b>\$358,333.66</b> |

Table 3. Section 319 & Local Match Expenditures – Aug. 1, 2018, through June 30, 2022

|                           |                  |
|---------------------------|------------------|
| Section 319 Funds         | \$215,000        |
| Burleigh County SCD Match | <u>143,333</u>   |
| <b>Total</b>              | <b>\$358,333</b> |

Table 4. Other Federal Expenditures – Aug. 1, 2018, through June 30, 2022

Not applicable.

Table 5. Cumulative Section 319 & Producer Expenditures on BMP as of June 30, 2022

Not applicable.

## **Project Progress:**

### ***Part I: Project's Goals and Objectives***

The primary goal of this project is to increase the ability of the agricultural community to improve water quality and use efficiency through soil health improvement. This will be accomplished by designing and implementing a planting green project that will integrate cover crops and livestock into simple crop rotations in the Northern Plains. By filling in the fallow seasons with live green plants, we will demonstrate numerous benefits such as the improvement of water usage and drainage; a reduction of wind and water erosion; and adding more carbon to the soil.

This planting green project's activities will be monitored and shared as part of the overall Burleigh County SCD/Menoken Farm natural resources educational program. Outreach will consist of hosting groups and entities, speaking requests, articles and multiple videos. The area of impact will include local, regional and national.

- **Objective 1:** Develop and deliver a planting green cropping plan
- **Objective 2:** Develop and deliver a planting green grazing plan
- **Objective 3:** Monitor planting green benefits
- **Objective 4:** Inform and educate the agricultural community

■ **Progress:** As of this final report, we have completed 100 percent toward the objectives outlined above. The overall progress is detailed under each task.

### ***Part II: Tasks and Accomplishments***

#### **Task 1: Seed and maintain fields and gardens**

After seeding, the Burleigh County SCD team will manage all herbicides, spraying, harvesting and trucking. This task will also include annual crop rotation and planting green cover crop management.

■ **Product:** A work plan that is carried out for seeding, annual crop rotation, managing herbicides, spraying, harvesting and trucking.

■ **Accomplishments to date:** Since Aug. 1, 2018, the crop fields were seeded to the crops indicated in the cropping plan shown. All fields have been planted no-till since 2009. The crop fields are maintained by applying herbicides appropriately and when needed. Compost and other biological agents are applied, and fields monitored. Harvesting is completed in a timely fashion of the various crops. The production is trucked to surrounding markets and sold.

During 2021 Jay Fuhrer and Ginny Mehlhoff of Burleigh County SCD completed a study of Menoken Farm cover crops and weed suppression impacts. The photos and frame weed counts shown on the next page were completed on fields 1, 3, 4, 8 and 9 on June 3, 2021. The results are as follows:

- Fields 1, 4 and 8 have an actively growing spring cover crop of cereal rye, which was seeded fall of 2020. Weed suppression is evident by the weed stand counts of one or zero

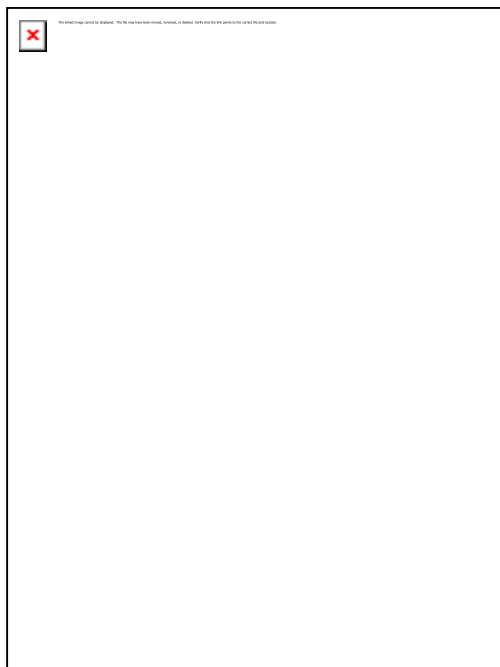
- Field 9 has a history of cover crop use but did not have a cover seeded the fall of 2020. Weed suppression is evident by the weed stand count of two
- Field 3 has never had a cover crop grown. It has a high weed count of 50 grass weeds, which consists of wild oats, pigeon grass and volunteer spring wheat



The produce from the outdoor garden is distributed to local food pantries. The cropland fields and outdoor garden serve as the backdrop for our numerous tours and guests at Menoken Farm.

The crop history for Menoken Farm during 2022 is listed in the right-hand column below. Also pictured below is the cereal rye cover crop prior to the spring of 2022 grazing and planting. The crop history for the entire grant period is as follows:

| Field | 2018   | 2019  | 2020  | 2021                                   | 2022                 |
|-------|--|---|---|--|----------------------|
| 1     | Perennial grass, 21 species  | Corn (60" and 30") with annual and perennial covers | Corn  | Warm-season cover crops                | Oats                 |
| 2     | Soybean  | Spring wheat, bioinoculant seed trench applied      | Seed perennials                                     | Perennial grass, added dormant alfalfa | Perennials           |
| 3     | Spring wheat   | Spring wheat  | Spring wheat  | Sunflower/cover crops                  | Flax and then sudan  |
| 4     | Cool-season cover crops; planted green                             | Corn (30") 4 gals. bioinoculant seed trench applied | Warm-season cover crops                             | Corn, 60" with covers                  | 60" corn with covers |
| 5     | Corn   | Warm-season cover crops; fall-seeded cereal rye     | Spring graze cereal rye; soybean, planted green     | Sunflower//cover crops solid seed      | 60" corn with covers |
| 6     | Canola, planted green; fall seeded cereal rye                      | Soybean, planted green                              | Flax  | Soybean                                | 60" corn with covers |
| 7     | Soybean, planted green   | Flax/pinto bean grazed; seeded to SW CL cover       | Spring wheat 15"), planted green; alfalfa interseed | Corn, 30" conventional hybrid          | 60" corn with covers |
| 8     | Corn RR, planted green   | Soybean, RR   | Corn  | RR soybean                             | Soybean              |
| 9     | Pea cover crop; rolled rye; warm-season cover crops, planted green | Warm-season cover crops                             | Pea/canola  | Spring wheat, 60"                      | Rye and then covers  |
| 10    | Perennial grass  | Perennial grass                                     | Perennial grass                                     | Perennial grass                        | Perennial grass      |



■ *Current status:* Complete

**Task 2: Manage and maintain compost materials**

The Burleigh County SCD team will perform all composting duties, such as adding new materials, aerating the pile, curing the compost and distributing the final compost to fields and the garden.

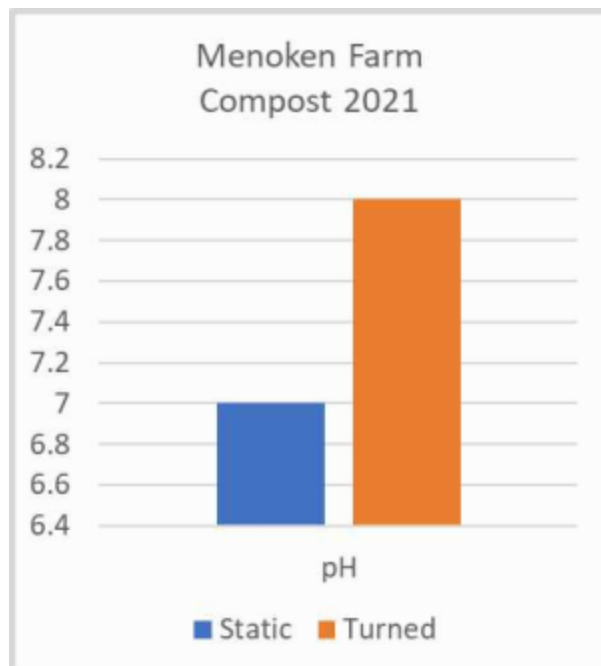
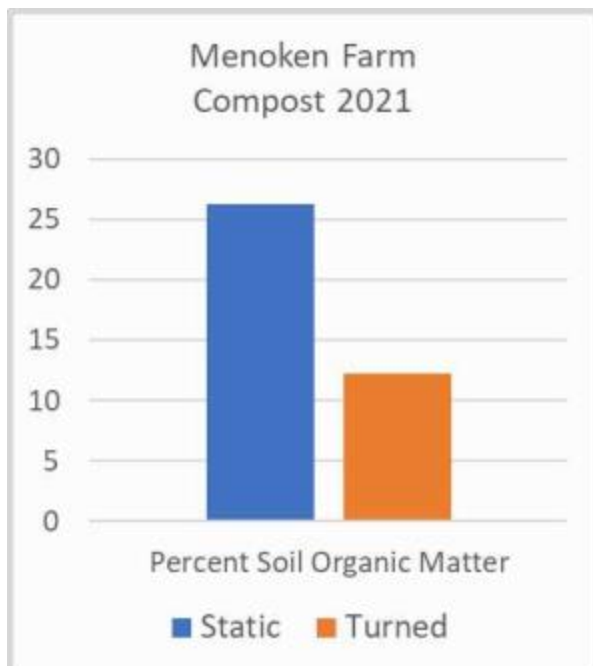
■ *Products:* Successful management and maintenance of compost materials.

■ *Accomplishments to date:* Compost was made in October 2020 with the following materials:

- Wood shavings
- Manure – dry
- Manure – wet
- Straw – rye
- Hay – ditch
- Hay – alfalfa
- Cured compost – inoculant
- Biochar – less than 5 percent by volume

The compost was finished during November 2021 with the addition of grass hay, alfalfa hay, straw bales, twice chipped wood chips, spent grain, dry cattle manure, wet dairy manure, biochar, grass clippings and leaves. The compost is being managed with turnings to enhance its quality. The manure is expected to be applied during the fall of 2022.

Below are the results of the 2021 compost by soil organic matter and by ph.





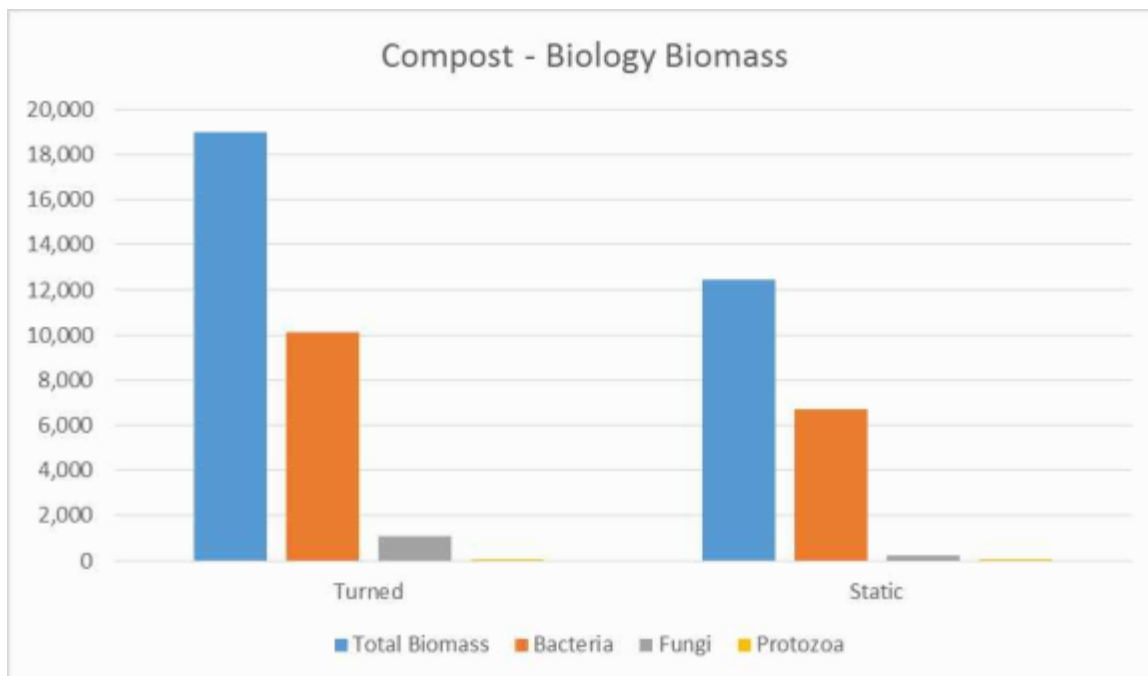
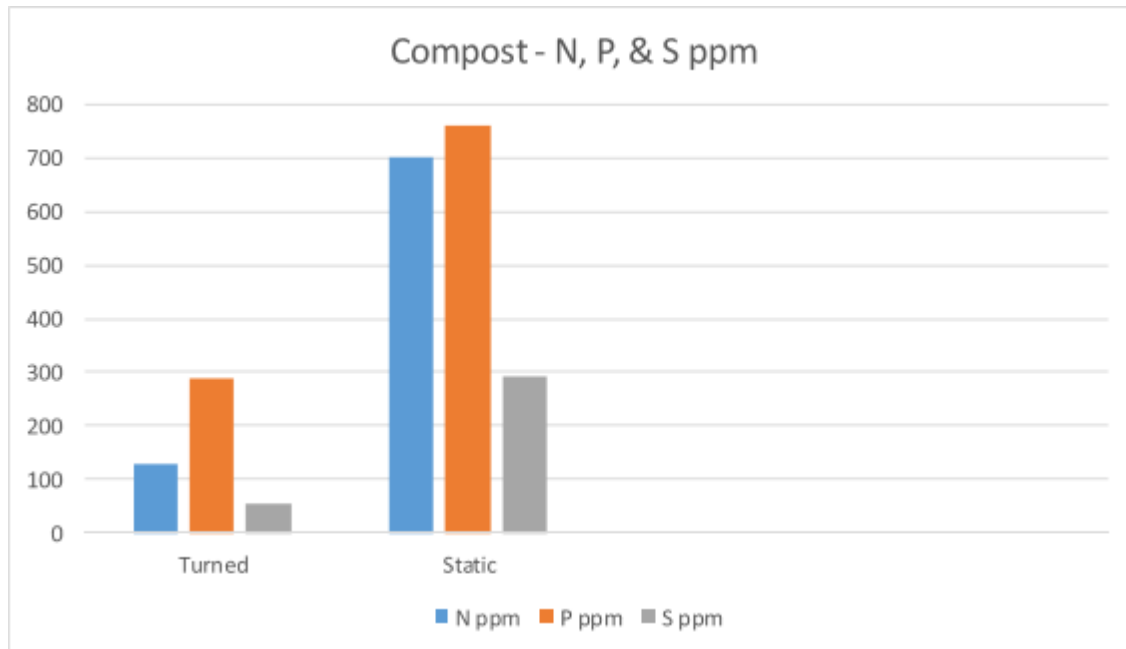
Vermicompost was also made during 2001 by placing completed compost into tubs and adding red wigglers and European night crawlers. Vermicompost liquid extract was then harvested and used to inoculate the high tunnel garden seed and the annual crop production for fields 1, and 3 through 9. Fields 2 and 10 are presently in perennials.

Rainwater is collected and used to water the worms and compost. The first photo below is the tubs used to extract the vermicompost liquid extract. The second photo shows the rainwater collection and the static bio reactors used to make static compost.



As previously reported, Menoken Farm has maintained one compost windrow that is static and one that is turned since the beginning of this grant. Cardboard tubes were used to help the heat escape from the windrow. The conventionally turned compost includes 5 percent biochar by volume. The previous comparison between the two types of compost to determine which one contains the most biology. The results showed that the static compost (shown in the “Compost – N, P, & S ppm chart” below) has significantly higher organic matter loss on ignition (LOI) percentage, in addition to the higher nitrate (N), phosphorous (P) and sulfur (S) parts per million (ppm).

The results for the turned compost (shown in the “Compost – Biology Biomass” chart on next page) showed it has significantly higher biological biomass.



- *Current status:* Complete

### Task 3: Maintain and manage high tunnel garden and Hunger Free Garden

The Burleigh County SCD will annually provide management and maintenance for the high tunnel garden, along with the outside Hunger Free Garden. All produce will be donated to the Bismarck/Mandan food pantries.

- *Products:* Properly maintained high tunnel and outdoor garden.

■ *Accomplishments to date:* During the fall of 2018, Burleigh County SCD staff constructed seven new raised beds for the high tunnel. In May 2019 the Menoken Farm also acquired two 2,200-gallon tanks for collection of rainwater to apply on the gardens. A new shade was added to the high tunnel during June 2020. A new shade cloth was installed on the high tunnel during the early summer of 2022. In addition, a leftover piece was applied during 2022 to the south side to provide shade for the existing cherry tree in the high tunnel.

The high tunnel was managed with a bioinoculant (worm juice) in 2021. Three applications were completed; one at planting time, a second after two to three weeks and a third after four to five weeks. The bioinoculant supplies a large amount of biology to the germinating seed. The biology, in turn, converts nutrient from organic to inorganic (plant available), as well as transports nutrients to the plant in exchange for carbon. The bioinoculant was sent to the Molecular Research-DNA Lab in Shallow Water, Texas, for analysis. The report indicated 5 phylum represented for the fungi and 12 phylum for the bacteria; with 370 total species.

A milpa garden was planted in the spring of 2020. The seed mixture was obtained from Green Cover Seeds, which lists on its Web site that “our milpa garden warm season mix is a great way to get fresh produce with minimal amounts of labor.” The milpa technique originated in Central America, where Mayans used a mixture of corn, squash and beans to improve the soil and grow food. According to Native American legend, these three crops are inseparable sisters who can only grow and thrive together. Green Cover Seed went beyond the Three Sisters and compiled a mix of more than 40 different seeds. The milpa mix includes varieties of clover, cowpeas, black bean, green beans, millet, collards, cabbage, mustard, radish, Swiss chard, okra, buckwheat, cucumbers, squash, zucchini, pumpkin, watermelon, melons, Marigold flower, Calendula flower, Cornflower, Cosmos flower and Nasturtium.

The 2018 harvest from the high tunnel and outdoor garden resulted in more than 1,000 pounds of vegetables. The produce was donated to Heaven’s Helpers Soup Café, Community Action Program Region VII and the Salvation Army, all in Bismarck. High tunnel produce included tomatoes, sweet potatoes, peppers, onions, carrots, okra and lettuce. Harvested from the large outdoor garden were corn, squash, potatoes, beans and cucumbers.

The 2019 garden produce, totaling about 1,500 pounds, was donated to Heaven’s Helpers Soup Café and Community Action. Produce grown in the high tunnel included tomatoes, peppers, nasturtium, beans, carrots, okra, tomatillos, corn and watermelon. The large outdoor garden produced squash, potatoes, pumpkins, watermelon, cucumbers, tomatoes and beans.

The 2020 gardens and the 2021 gardens each produced more than 2,000 pounds of produce that was primarily donated to Heaven’s Helpers Soup Café and Sunne Lutheran Church.

About 30 pounds of produce from the 2022 gardens have been harvested through June 30, 2022. The produce has been donated to Heaven’s Helpers Soup Café in Bismarck every week.

For the 2022 gardening season, BCSCD decided to try companion planting in most of the high tunnel planter beds. Companion planting provides many benefits, which are explained in the planting combinations on the next page.



BCSCD staff started planting in the high tunnel on May 3, 2022. The companion planting consisted of the following:

- *Parsnips and garlic*: The parsnips are deep rooted whereas the garlic is shallow rooted and deters aphids.
- *Onions and chamomile* : Chamomile improves the growth and flavor of onions.
- *Carrots and chives*: Chives improve the growth and flavor of carrots as well as deter carrot flies.
- *Radish and kale*: Radish and kale act as a great trap crop for pests.
- *Leeks and spinach*: Both keep away pests.
- *Cucumbers and dill*: The dill attracts honeybees, which help in pollination of the cucumbers.
- *Basil and tomatoes*: Basil helps improve the growth, flavor and yield of tomatoes.
- *Cilantro, parsley and rosemary and peppers*: All repel aphids and spider mites and attract bees.
- *Beets and kohlrabi* : Beets enrich the soil and improve the quality and growth of kohlrabi. They also take soil nourishment at different levels.
- *Lemon balm and muskmelon*: This perennial herb attracts bees and other beneficial pollinators, while the strong, citrusy odor deters several unwelcome pests, including gnats and mosquitoes.

The remaining high tunnel raised beds were planted to lettuce, sweet potatoes, peanuts and flowers.

The outdoor garden was planted June 2 and 3, 2022. Sweet potatoes were planted into straw bales. The rest of the garden—squash, watermelon, cabbage and beans—were planted into fabric weed barrier.

After the harvests were completed each year in the high tunnel, cover crops were successfully planted in the raised beds. The gardens at Menoken Farm are a cooperative effort supporting the Hunger Free North Dakota Garden Project and USDA's People's Garden Initiative.

A Haney Analysis was conducted on the outdoor garden May 13, 2021. Two different residue amounts were computed: 1) Milpa residue; and 2) cereal rye residue. Sweet corn was then planted on both residue types, with tissue samples taken. The sweet corn was inoculated with the vermicompost liquid extract at seeding time and again as a foliar at the V5 stage, along with an application of compost. No other amendments were applied. The results are as follows:

| Residue type (2020) | Ph  | SOM percent | Total N lbs./acre | P205 lbs./acre | K20 lbs./acre | Soil respiration PPM C | C:N  |
|---------------------|-----|-------------|-------------------|----------------|---------------|------------------------|------|
| Milpa               | 6.8 | 4.4         | 82                | 99             | 395           | 163                    | 13.0 |
| Cereal rye          | 7.3 | 5.0         | 90                | 343.6          | 658           | 157                    | 10.0 |

Account No. : 21172

Plant Analysis Report

FUHRER, JAY  
BURLEIGH CO SOIL CONS DIST  
916 E INTERSTATE AVE STE 6  
BISMARCK ND 58503-0548

Invoice No. : 1349443  
Date Received : 07/22/2021  
Date Reported : 07/26/2021

Lab Number : 5697

Results For MENOKEN FARM  
Location : SWEET CORN  
Sample ID : ROW 7

Plant Type : Corn  
Stage : Tassel

|                    | Result<br>Dry Basis | Sufficiency Levels |     |            |      |
|--------------------|---------------------|--------------------|-----|------------|------|
|                    |                     | Deficient          | Low | Sufficient | High |
| Nitrogen, % N      | 3.442               |                    |     |            |      |
| Phosphorus, % P    | 0.281               |                    |     |            |      |
| Potassium, % K     | 3.86                |                    |     |            |      |
| Calcium, % Ca      | 0.771               |                    |     |            |      |
| Magnesium, % Mg    | 0.396               |                    |     |            |      |
| Sulfur, % S        | 0.296               |                    |     |            |      |
| Zinc, ppm Zn       | 18                  |                    |     |            |      |
| Iron, ppm Fe       | 126                 |                    |     |            |      |
| Manganese, ppm Mn  | 52                  |                    |     |            |      |
| Copper, ppm Cu     | 9.1                 |                    |     |            |      |
| Boron, ppm B       | 7.3                 |                    |     |            |      |
| Molybdenum, ppm Mo | 0.64                |                    |     |            |      |

■ **Current status:** Complete

**Task 4: Care for and handle animals**

The plan of work for the farm will include purchasing and proper watering and feeding of the livestock.

■ **Products:** Successful selection and proper care of animals

■ **Accomplishments to date:** The 19 yearling heifers that were purchased in May 2018 grazed multi-species cover crops until their marketing date in mid-October of 2018. Other livestock included goats, chickens and sheep, which grazed with the heifers at various intervals. The sheep were borrowed from the Hettinger Extension Research Station and the goats from a local producer.

A new set of 14 yearling heifers were purchased in May 2019. We again received 20 sheep from the Hettinger Extension Research Station and leased 11 Katahdin sheep from Holly Rose and Barry Mawby, Harvey. The cattle were trained for electric fence and then quickly moved out to the perennial pastures.

During 2019, Menoken Farm raised its own broiler chickens and purchased some hens from a local producer.

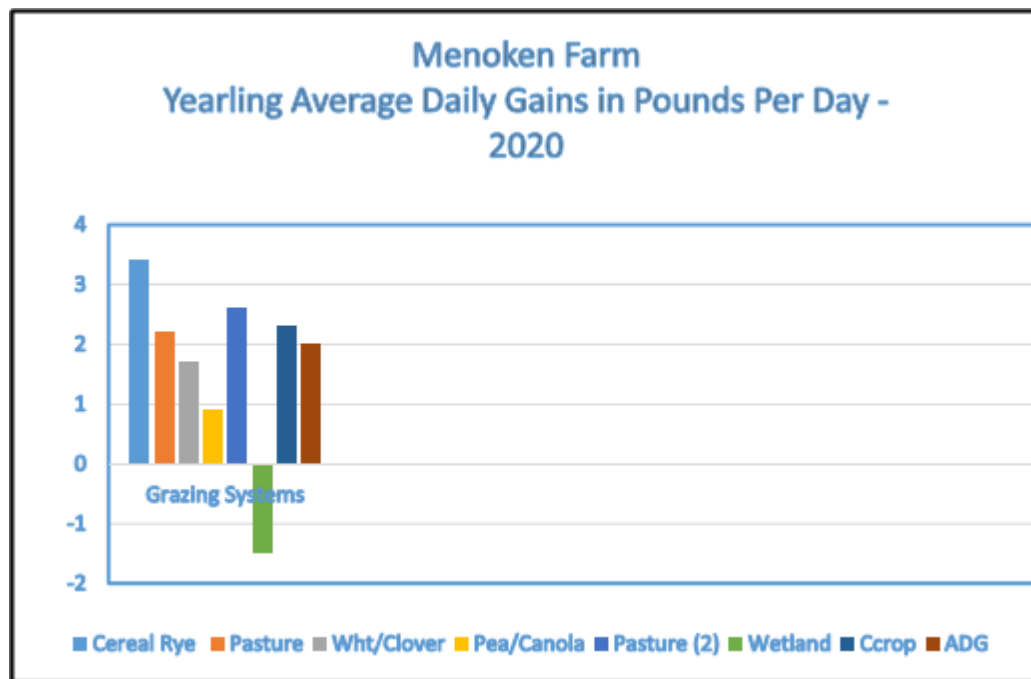
A total of 25 yearling heifers were purchased in the spring of 2020.

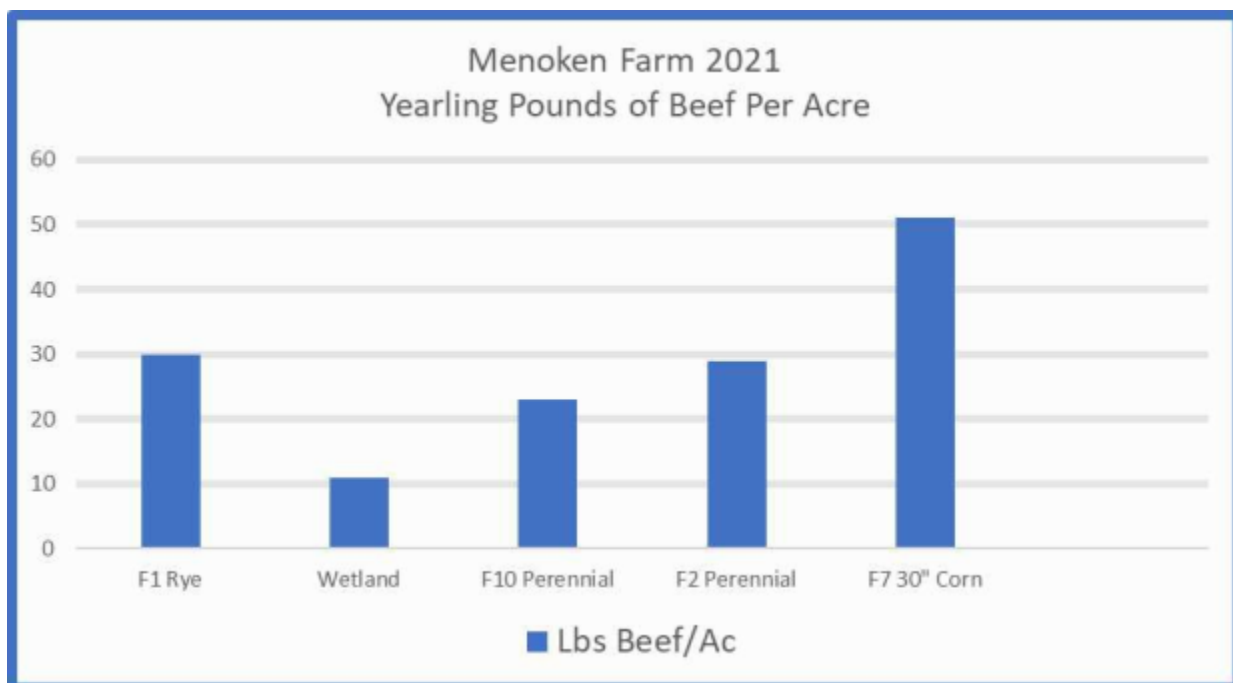
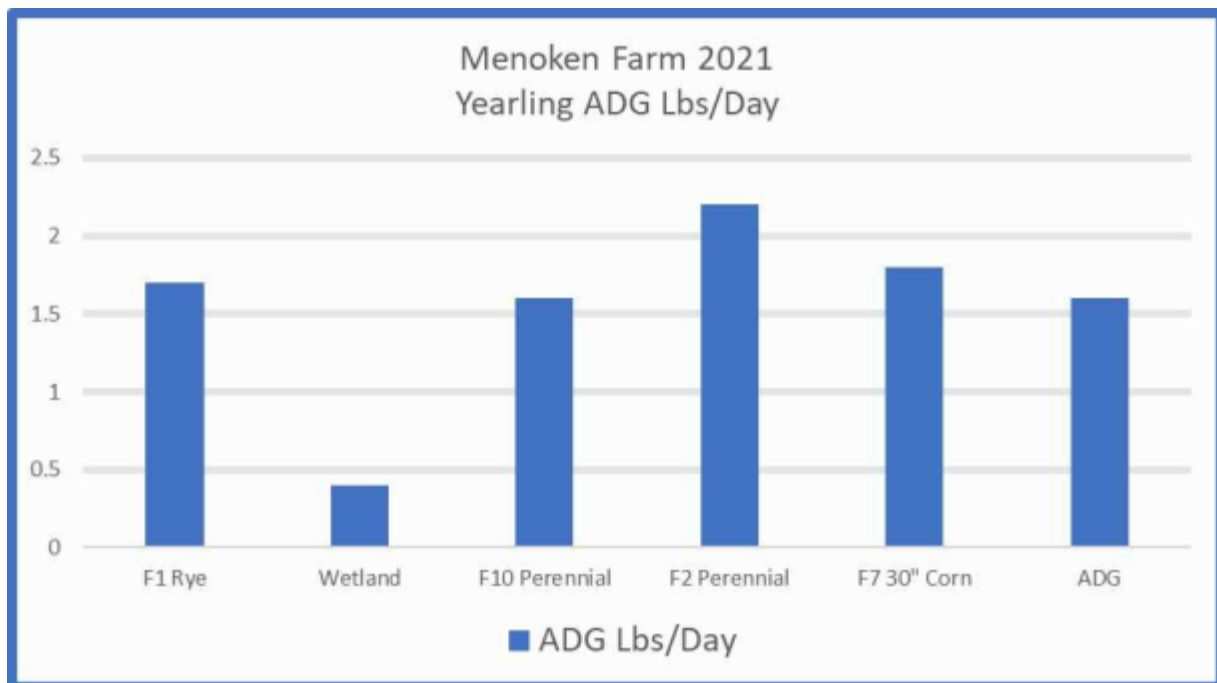
A total of 10 open yearling heifers were purchased in the spring of 2021. The number was lower this year due to the drought conditions. Burleigh County SCD also borrowed 20 dry ewes from NDSU Hettinger.

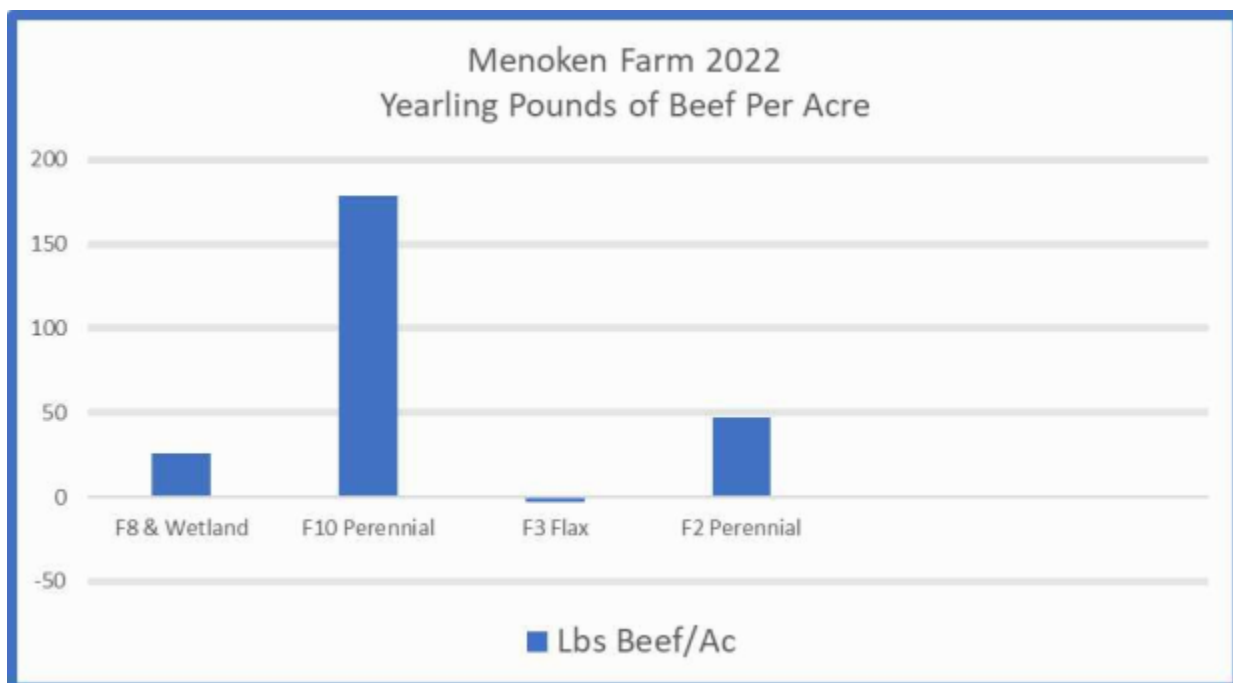
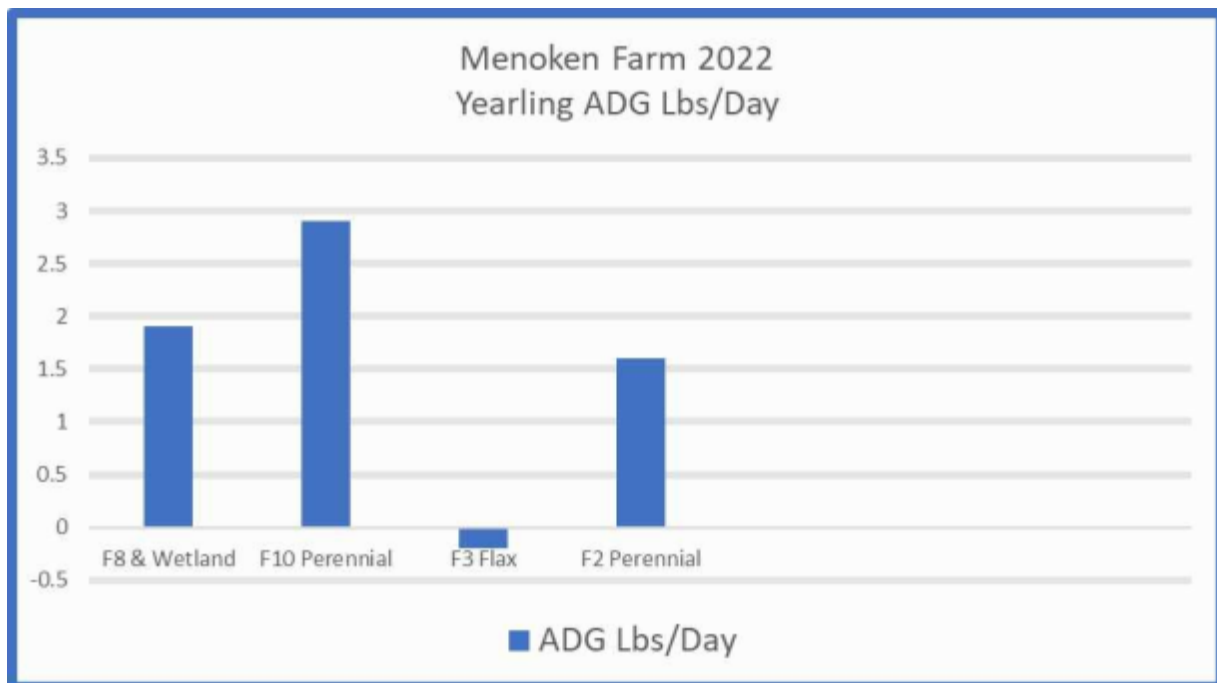
During this last reporting period, a total of 18 yearling heifers were purchased in May 2022. In addition, Darrell Oswald of Burleigh County SCD brought two steers to Menoken Farm.

The livestock are moved every day, except for the weekends, when they are given enough forage to last for two days. Approximately 50 percent of the forage is grazed, and the remaining portion is trampled to the soil surface. This ensures that the soil has adequate armor and carbon; both building soil resiliency for the next year.

A new livestock scale was purchased and installed in 2020. It allows individual weights to be tracked after every rotational move to a new pasture/cover crop. The bar charts that follow summarizes the yearlings' average daily gains in pounds per day for 2020, 2021 and 2022. There are also two bar charts that show the yearling pounds of beef per acre in 2021 and 2022.







- *Current status:* Complete

#### Task 5: Manage cover crop rotational grazing

The plan will cover the proper schedules for cover crop grazing rotations during this plant green project.

- *Products:* Successful management and use of grazing animals

■ *Accomplishments to date:* A mobile watering system was developed to facilitate a grazing structure of long, narrow paddocks. The perennial pastures are a mixture of more than a dozen species. An intercropping field was also grazed to utilize a not-so-successful attempt at intercropping. Warm, full-season cover crops were also utilized, as well as an underdeveloped cornfield. A manure sample was taken from the yearling heifers while they were grazing the corn field. This was done to determine any deficiency that may be occurring. All fields were managed using short exposure periods and long recovery periods for maximum animal input and soil regeneration effects.

### Grazing system 2018

| Field/pasture                                | Paddock size | Grazing                               | Days      | Total yearlings | Sheep |
|--|--------------|---------------------------------------|-----------|-----------------|-------|
| Field 12 – 12 acres; 2 <sup>nd</sup> grazing | ½ acre       | 8-1-18 to 8-21-18, moved once per day | 21        | 19              | 20    |
| Field 4 – 12 acres                           | ½ acre       | 8-22-18 to 9-18-18 moved once per day | 28        | 19              | 20    |
|  |              | <b>Total days</b>                     | <b>49</b> |                 |       |

### Grazing system 2019

| Field/pasture                               | Paddock size | Grazing            | Days       | Total yearlings | Sheep |
|---|--------------|--------------------|------------|-----------------|-------|
| Field 10 – 12 acres                         | ¼ acre       | 5-30-19 to 7-24-19 | 56         | 14              |       |
| Field 7 – 6 acres                           | ½ acre       | 7-25-19 to 8-15-19 | 22         | 14              |       |
| Field 10 – 7 acres; 2 <sup>nd</sup> grazing | ¼ acre       | 8-16-19 to 9-13-19 | 29         | 14              |       |
|   |              | <b>Total days</b>  | <b>107</b> |                 |       |

### Grazing system 2020

*Cereal rye:* Grazed from May 20 to June 3 for a total of 14 days (includes shrink gains)

*Pasture:* Grazed from June 3 to June 26 for a total of 23 days

*Wheat/clover:* Grazed from June 26 to July 8 for a total of 12 days

*Pea/Canola:* Grazed from July 8 to July 17 for a total of 9 days

*Pasture (2):* Grazed from July 17 to Aug. 10 for a total of 24 days

*Wetland:* Grazed from August 10 to Aug. 19 for a total of 9 days

ADG: 14,875 lbs. minus 19,256/91 grazing days/25 head = 1.9 lbs. per day

*Notes:* The date range was computed with the first and last days as half days.

Pasture lbs. of beef/ac: 1,259 lbs. + 1,544 lbs. = 2,803 lbs. gain/13 ac = 216 lbs./ac



| Menoken Farm 2020          |                                  |                                |        |        |        |        |      |     |
|----------------------------|----------------------------------|--------------------------------|--------|--------|--------|--------|------|-----|
| Observations               | Tag Number                       | Yearling Weights               |        |        |        |        |      |     |
|                            |                                  | 6/3                            | 6/2    | 7/8    | 7/17   | 8/10   | 8/19 | 9/8 |
|                            | 809                              | 674                            | 712    | 728    | 744    | 796    | 772  | 836 |
|                            | 19P                              | 672                            | 731    | 756    | 758    | 828    | 824  | 872 |
|                            | C8                               | 742                            | 792    | 810    | 790    | 858    | 844  | 908 |
|                            | Yellow 10 (Solid Black – no tag) | 664                            | 713    | 754    | 754    | 818    | 816  | 860 |
|                            | Yellow 14 (Solid Red – no tag)   | 614                            | 665    | 688    | 704    | 774    | 760  | 808 |
|                            | C35                              | 670                            | 722    | 744    | 762    | 822    | 802  | 866 |
|                            | 182                              | 562                            | 614    | 640    | 640    | 704    | 682  | 720 |
|                            | C58                              | 638                            | 708    | 696    | 722    | 786    | 790  | 832 |
|                            | B48                              | 726                            | 792    | 824    | 828    | 884    | 882  | 942 |
|                            | C49                              | 670                            | 720    | 735    | 732    | 778    | 768  | 794 |
|                            | O39                              | 738                            | 782    | 790    | 776    | 854    | 820  | 858 |
|                            | 54                               | 568                            | 616    | 652    | 666    | 746    | 738  | 792 |
|                            | 118                              | 558                            | 622    | 642    | 654    | 732    | 694  | 754 |
|                            | 215                              | 516                            | 562    | 576    | 598    | 656    | 644  | 684 |
|                            | Yellow 8 (Small Black – no tag)  | 514                            | 562    | 606    | 594    | 676    | 662  | 714 |
|                            | 207                              | 690                            | 736    | 750    | 746    | 814    | 786  | 822 |
|                            | 19D                              | 708                            | 733    | 770    | 804    | 820    | 830  | 860 |
|                            | 20                               | 714                            | 770    | 792    | 812    | 866    | 858  | 918 |
|                            | C39                              | 626                            | 673    | 690    | 720    | 758    | 760  | 782 |
|                            | 12                               | 700                            | 754    | 756    | 768    | 820    | 784  | 820 |
|                            | Yellow 6 (Big Red – no tag)      | 666                            | 712    | 738    | 754    | 796    | 760  | 804 |
|                            | 120                              | 580                            | 622    | 648    | 644    | 724    | 722  | 772 |
|                            | C67                              | 694                            | 738    | 738    | 742    | 802    | 814  | 834 |
|                            | Yellow 12 (Black – no tag)       | 566                            | 614    | 654    | 664    | 730    | 722  | 770 |
|                            | 148                              | 592                            | 656    | 660    | 670    | 748    | 722  | 780 |
| Total number               | 25                               |                                |        |        |        |        |      |     |
| Total herd lbs             |                                  | 16,062                         | 17,321 | 17,837 | 18,046 | 19,590 |      |     |
|                            |                                  | 19,256                         | 20,402 |        |        |        |      |     |
| Average weight on May 20   | Purchase date                    | 14,875/25 = 595 lbs            |        |        |        |        |      |     |
| Average weight on June 3   | Finished grazing F5 Cereal Rye   | 16,062/25 = 642 lbs            |        |        |        |        |      |     |
| Average weight on June 26  | Finished grazing F10 Pasture     | 17,321/25 = 692 lbs            |        |        |        |        |      |     |
| Average weight on July 8   | Finished grazing F7 Wht/Clover   | 17,837/25 = 713 lbs            |        |        |        |        |      |     |
| Average weight on July 17  | Finished grazing F9 Pea/Canola   | 18,046/25 = 722 lbs            |        |        |        |        |      |     |
| Average weights on Aug. 10 | Finished grazing F10 Pasture (2) | 19,590/25 = 784 lbs            |        |        |        |        |      |     |
| Average weights on Aug. 19 | Finished grazing Wetland         | 19,256/25 = 770 lbs            |        |        |        |        |      |     |
| Average Weights on Sept. 8 | Finished grazing F4 Cover Crop   | 20,402/25 = 816 lbs            |        |        |        |        |      |     |
| ADG May 20 – June 3        | 14,875 – 16,062 = 1,187 lbs      | 1,187/14 days/25 = 3.4 lbs/day |        |        |        |        |      |     |
| ADG June 3 – June 26       | 16,062 – 17,321 = 1,259 lbs      | 1,259/23 days/25 = 2.2 lbs/day |        |        |        |        |      |     |
| ADG June 26 – July 8       | 17,321 – 17,837 = 516 lbs        | 516/12 days/25 = 1.7 lbs/day   |        |        |        |        |      |     |

## Grazing system 2021

| Menoken Farm 2021                   |                                |   |      |      |      |      |
|-------------------------------------|--------------------------------|---|------|------|------|------|
| Tag Number<br>Yearling Open Heifers | Total lbs. of gain to date     | Yearling Weights                            |      |      |      |      |
|                                     |                                | 6/29  | 7/13 | 7/28 | 8/11 | 9/10 |
| Y1                                  | 124                            | 652   | 664  | 694  | 714  | 776  |
| R865                                | 156                            | 674   | 724  | 746  | 760  | 830  |
| B900                                | 128                            | 606   | 630  | 652  | 688  | 734  |
| R851                                | 122                            | 634   | 634  | 688  | 698  | 756  |
| R791                                | 110                            | 674   | 682  | 720  | 730  | 784  |
| Y2                                  | 120                            | 670   | 658  | 704  | 752  | 790  |
| R862                                | 106                            | 702   | 698  | 716  | 752  | 808  |
| R620                                | 128                            | 728   | 746  | 760  | 808  | 856  |
| R849                                | 61                             | 675   | 614  | 630  | 680  | 736  |
| Y3                                  | 110                            | 636   | 666  | 660  | 682  | 746  |
| B905                                | 126                            | 782   | 780  | 802  | 852  | 908  |
|                                     |                                |   |      |      |      |      |
| Average Weights                     |                                |   |      |      |      |      |
| Average weight on June 10           | Purchase Date                  | 7070/11 = 643 lbs. Ave Wt                   |      |      |      |      |
| Average weight on June 29           | Finished grazing F1 Cereal Rye | 7433/11 = 676 lbs. Ave Wt                   |      |      |      |      |
| Average weight on July 13           | Finished grazing wetland       | 7496/11 = 681 lbs. Ave Wt                   |      |      |      |      |
| Average weight on July 28           | Finished grazing F10 Perennial | 7772/11 = 707 lbs. Ave Wt                   |      |      |      |      |
| Average weight on August 11         | Finished grazing F2 Perennial  | 8116/11 = 738 lbs. Ave Wt                   |      |      |      |      |
| Average weight on Sept 10           | Finished grazing F7 30" Corn   | 8724/11 = 793 lbs. Ave Wt                   |      |      |      |      |
|                                     |                                |   |      |      |      |      |
| Average Daily Gains                 |                                |   |      |      |      |      |
| ADG June 10 – June 29               | 7070 – 7433 = 363 lbs. Gained  | 363/19 Days/11 = 1.7 lbs./Day F1 Rye        |      |      |      |      |
| ADG June 29 – July 13               | 7433 – 7496 = 63 lbs. Gained   | 63/14 Days/11 = 0.4 lbs./Day FWetland       |      |      |      |      |
| ADG July 13 – July 28               | 7496 – 7772 = 276 lbs. Gained  | 276/16 Days/11 = 1.6 lbs./Day F10 Perennial |      |      |      |      |
| ADG July 28 – Aug 11                | 7772 – 8116 = 344 lbs. Gained  | 344/14 Days/11 = 2.2 lbs./Day F2 Perennial  |      |      |      |      |
| ADG Aug 11 – Sept 10                | 8116 – 8724 = 608 lbs. Gained  | 608/30 Days/11 = 1.8 lbs./Day F7 30" Corn   |      |      |      |      |
| ADG June 10 – Sept 10               | 7070 – 8724 = 1654 lbs. Gained | 1654/92 Days/11 = 1.6 lbs./Day to Date      |      |      |      |      |
|                                     |                                |   |      |      |      |      |
| Pounds of Beef Per Acre             |                                |   |      |      |      |      |
| Field 1 Cereal Rye                  | 363 lbs./12 Ac = 30 lbs./Ac    |   |      |      |      |      |
| Field Wetland                       | 63 lbs./6 Ac = 11 lbs./Ac      |   |      |      |      |      |
| Field 10 Perennial                  | 276 lbs./12 = 23 lbs./Ac       |   |      |      |      |      |

## Grazing system 2022

| Field/pasture       | Paddock size | Grazing                               | Days      | Total yearlings | Steers |
|---------------------|--------------|---------------------------------------|-----------|-----------------|--------|
| Field 9 Rye         | ½ acre       | 5-27-22 to 6-2-22, moved once per day | 7         | 18              | 2      |
| Field 10 Perennials | ½ acre       | 6-3-22 to 6-30-22, moved once per day | 28        | 18              | 2      |
|                     |              | <b>Total days</b>                     | <b>35</b> |                 |        |

| Menoken Farm 2022                   |                                 |   |      |      |      |  |
|-------------------------------------|---------------------------------|---|------|------|------|--|
| Tag Number<br>Yearling Open Heifers | Total lbs of gain to date       | Yearling Weights                            |      |      |      |  |
|                                     |                                 | 6/2   | 7/13 | 7/22 | 8/11 |  |
| W151                                | 142                             | 544   | 678  | 644  | 694  |  |
| R28                                 | 162                             | 652   | 786  | 804  | 816  |  |
| R20                                 | 98                              | 546   | 658  | 610  | 640  |  |
| W12                                 | 156                             | 622   | 748  | 720  | 772  |  |
| WNT                                 | 344                             | 548   | 712  | 726  | 766  |  |
| R3                                  | 176                             | 606   | 710  | 710  | 792  |  |
| W144                                | 124                             | 582   | 674  | 688  | 702  |  |
| Y141                                | 128                             | 574   | 644  | 682  | 696  |  |
| Y2                                  | 146                             | 590   | 702  | 692  | 740  |  |
| R13                                 | 132                             | 554   | 676  | 664  | 696  |  |
| Y12                                 | 132                             | 512   | 636  | 632  | 654  |  |
| Y1                                  | 124                             | 572   | 676  | 672  | 704  |  |
| Y136                                | 160                             | 566   | 702  | 690  | 716  |  |
| Y146                                | 190                             | 528   | 668  | 690  | 710  |  |
| P2                                  | 128                             | 564   | 672  | 668  | 698  |  |
| W51                                 | 148                             | 590   | 720  | 730  | 742  |  |
| Y190                                | 140                             | 506   | 628  | 626  | 638  |  |
| R36                                 | 154                             | 532   | 644  | 650  | 690  |  |
|                                     |                                 |   |      |      |      |  |
| Average Weights                     |                                 |   |      |      |      |  |
| Average weight on May 19            | Purchase Date-Delivery          | 9720/18 = 540 lbs Ave Wt                    |      |      |      |  |
| Average weight on June 2            | Finished grazing F8 & Wetland   | 10188/18 = 566 lbs Ave Wt (Planting Green)  |      |      |      |  |
| Average weight on July 13           | Finished grazing F10 Perennial  | 12334/18 = 685 lbs Ave Wt                   |      |      |      |  |
| Average weight on July 22           | Finished grazing F3 Flax        | 12298/18 = 683 lbs Ave Wt                   |      |      |      |  |
| Average weight on Aug 11            | Finished grazing F2 Perennial   | 12862/18 = 714 lbs Ave Wt                   |      |      |      |  |
|                                     |                                 |   |      |      |      |  |
|                                     |                                 |   |      |      |      |  |
| Average Daily Gains                 |                                 |   |      |      |      |  |
| ADG May 19 – June 2                 | 9720 - 10188 = 468 lbs Gained   | 468/14 Days/18 = 1.9 lbs/Day F8 & Wetland   |      |      |      |  |
| ADG June 2 – July 13                | 10188 – 12334 = 2146 lbs Gained | 2146/41 Days/18 = 2.9 lbs/Day F10 Perennial |      |      |      |  |
| ADG July 13 – July 22               | 12334 – 12298 = -36 lbs Gained  | -36/9 Days/18 = -0.2 lbs/Day F3 Flax        |      |      |      |  |
| ADG July 22 – Aug 11                | 12298 – 12862 = 564 lbs Gained  | 564/20 Days/18 = 1.6 lbs/Day F2 Perennial   |      |      |      |  |
| ADG Aug 11 -                        |                                 |   |      |      |      |  |
|                                     |                                 |   |      |      |      |  |
| Pounds of Beef Per Acre             |                                 |   |      |      |      |  |
| Field 8 Cereal Rye &Wetland         | 468 lbs/18 Ac = 26 lbs/Ac       |   |      |      |      |  |
| Field 10 Perennial                  | 2146 lbs/12 Ac = 179 lbs/Ac     |   |      |      |      |  |
| Field 3 Flax                        | -36 lbs/12 Ac = -3 lbs/Ac       |   |      |      |      |  |

■ *Current status:* Complete

**Task 6: Annually monitor impacts from all 10 Menoken Farm fields**

Approximately 60 soil samples will be taken and analyzed over the three-year period of this project.

■ *Products:* Approximately 60 completed and analyzed soil samples

■ *Accomplishments to date:* A total of 422 soil tests were done during the entire grant period of Aug. 1, 2018, and June 30, 2022. Of this number, 47 tests were conducted the end of 2018; 92 tests were conducted during 2019; 126 tests were conducted during 2020; 114 tests were conducted during 2021 and 42 tests were conducted during 2022.

The 422 soil tests included 168 PLFA; 132 standard; 64 Haney; 31 plant tissue; 17 soil health assessment; and 10 total mineral. The majority of the testing (381) was conducted on the 10 cropland fields. A total of 35 soil tests were done on the outside garden and 6 tests were done on the high tunnel soil. See all the soil tests below.

| Soil Test              | Number | Location           | Month/Year |
|------------------------|--------|--------------------|------------|
| PLFA                   | 7      | 10 Cropland Fields | 11/2018    |
| Standard               | 7      | 10 Cropland Fields | 11/2018    |
| PLFA                   | 13     | 10 Cropland Fields | 11/2018    |
| PLFA                   | 20     | 10 Cropland Fields | 12/2018    |
|                        |        |                    |            |
| Standard               | 4      | 10 Cropland Fields | 1/2019     |
| Standard               | 20     | 10 Cropland Fields | 5/2019     |
| PLFA                   | 20     | 10 Cropland Fields | 5/2019     |
| Plant Tissue           | 5      | 3 Cropland Fields  | 7/2019     |
| PLFA                   | 5      | 3 Cropland Fields  | 7/2019     |
| Standard               | 5      | 3 Cropland Fields  | 7/2019     |
| PLFA                   | 3      | 3 Cropland Fields  | 8/2019     |
| Standard               | 10     | 10 Cropland Fields | 11/2019    |
| PLFA                   | 20     | 10 Cropland Fields | 11/2019    |
|                        |        |                    |            |
| Standard               | 28     | 10 Cropland Fields | 6/2020     |
| PLFA                   | 28     | 10 Cropland Fields | 6/2020     |
| Haney                  | 28     | 10 Cropland Fields | 6/2020     |
| Plant Tissue           | 10     | 10 Cropland Fields | 7/2020     |
| Plant Tissue           | 2      | 10 Cropland Fields | 6/2020     |
| Standard               | 10     | 10 Cropland Fields | 10/2020    |
| Haney                  | 10     | 10 Cropland Fields | 10/2020    |
| PLFA                   | 10     | 10 Cropland Fields | 10/2020    |
|                        |        |                    |            |
| Standard               | 20     | 10 Cropland Fields | 5/2021     |
| Standard               | 2      | Outside Garden     | 5/2021     |
| Standard               | 2      | High Tunnel        | 5/2021     |
| Standard               | 8      | Outside Garden     | 7/2021     |
| Standard               | 16     | 10 Cropland Fields | 7/2021     |
| Plant Tissue           | 8      | Outside Garden     | 7/2021     |
| Plant Tissue           | 6      | 6 Cropland Fields  | 7/2021     |
| PLFA                   | 8      | Outside Garden     | 7/2021     |
| PLFA                   | 2      | High Tunnel        | 7/2021     |
| PLFA                   | 16     | 10 Cropland Fields | 7/2021     |
| Haney                  | 8      | Outside Garden     | 7/2021     |
| Haney                  | 2      | High Tunnel        | 7/2021     |
| Haney                  | 16     | 10 Cropland Fields | 7/2021     |
|                        |        |                    |            |
| Total Mineral          | 10     | 10 Cropland Fields | 6/2022     |
| Soil Health Assessment | 16     | 10 Cropland Fields | 6/2022     |
| Soil Health Assessment | 1      | Outside Garden     | 6/2022     |
| PLFA                   | 16     | 10 Cropland Fields | 6/2022     |

Soil tests were conducted during the spring of 2019 to track organic carbon parts per million (PPM); phospholipid fatty acids (PLFA); and the percentage of soil organic matter (SOM) on each of the 10 fields that make up Menoken Farm. The monitoring data was taken from two sampling points in each of the 10 fields. A sampling point consists of 15 core samples each.

The results clearly show that the soil health principles, combined with Best Management Practices, have moved the Menoken Farm fields in an overall upward trend for carbon, biology and SOM. It illustrates, in the vast majority of fields, how additional carbon is having a positive impact on the soil biology and, consequently, the SOM. As shown in the following graph, the average percentage of SOM was 4.31 in the spring of 2019, up 15.2 percent from the spring of 2016, when it was 3.74 percent.

Test averages for 2020 show organic carbon PPM at 212. The PLFA is 1887 and the SOM is 4.3. These lower numbers are from the lack of precipitation in 2020, which had a negative impact on PPM, PLFA and SOM. Precipitation from Jan. 1, 2020, to Sept. 16, 2020, was recorded at 7.13 inches. According to the Bismarck Tribune, the normal precipitation for the same period is 14.71 inches.

**Organic carbon PPM, PLFA and SOM**

| <b>Test averages</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>2019</b> | <b>2020</b> |
|----------------------|-------------|-------------|-------------|-------------|-------------|
| Organic carbon PPM   | 126.5       | 153.7       | 212.5       | 248.5       | 212.0       |
| PLFA                 | 1818        | 2671        | 3229        | 3575        | 1887        |
| SOM                  | 3.74        | 3.91        | 3.98        | 4.31        | 4.03        |

Total nitrogen is split between the stable organic nitrogen and unstable inorganic nitrogen for two sampling sites per field. The data in the table below clearly shows the correlation of nitrogen with a green plant. For example, field 3 has no history of a cover crop or crop diversity. Consequently, it had the highest percent (average of 72.0 percent) of inorganic nitrogen available during the spring of 2018. This is a negative aspect for water quality. This trend was repeated in 2019.

In comparison, fields 6 and 7 have a history of high plant diversity and cover crops. They had a much lower percentage of inorganic nitrogen available during the spring of 2018 and 2019. Field 7 was planted green during the spring of 2018. Field 6 was planted green the spring of 2019. This is a positive aspect for water quality and the nutrient cycle.

In addition, field 1 was in a perennial in 2018, while field 10 was in a perennial in both 2018 and 2019. Now the percentage of inorganic nitrogen has reached an even lower level. Again, this is a positive aspect for water quality.

### 2018 nitrogen

| Field                       | 2018<br>inorganic<br>nitrogen<br>PPM | Percentage<br>inorganic<br>nitrogen<br>PPM | 2018<br>organic<br>nitrogen<br>PPM | Percentage<br>organic<br>nitrogen<br>PPM | Total 2018<br>nitrogen<br>PPM |
|-----------------------------|--------------------------------------|--|------------------------------------|--|-------------------------------|
| 1E (perennial)              | 10.0                                 | 34.6%                                      | 19.4                               | 67.1%                                    | 28.9                          |
| 1W (perennial)              | 9.0                                  | 34.6%                                      | 17.5                               | 67.3%                                    | 26.0                          |
| 3E (wheat, no cover crops)  | 38.9                                 | 71.9%                                      | 17.5                               | 32.3%                                    | 54.1                          |
| 3W (wheat, no cover crops)  | 40.1                                 | 72.4%                                      | 15.4                               | 27.8%                                    | 55.4                          |
| 5E (corn, planted brown)    | 44.3                                 | 67.0%                                      | 21.7                               | 32.8%                                    | 66.1                          |
| 5W (corn, planted brown)    | 45.3                                 | 65.1%                                      | 23.7                               | 34.1%                                    | 69.6                          |
| 7E (soybean, planted green) | 12.5                                 | 32.5%                                      | 26.1                               | 67.8%                                    | 38.5                          |
| 7W (soybean, planted green) | 17.7                                 | 44.3%                                      | 21.6                               | 54.0%                                    | 40.0                          |
| 8E (corn, planted green)    | 16.8                                 | 42.6%                                      | 22.2                               | 56.3%                                    | 39.4                          |
| 8W (corn, planted green)    | 13.4                                 | 37.5%                                      | 21.3                               | 59.7%                                    | 35.7                          |
| 10E (perennial)             | 9.3                                  | 30.9%                                      | 20.7                               | 68.8%                                    | 30.1                          |
| 10W (perennial)             | 8.8                                  | 29.9%                                      | 21.1                               | 71.8%                                    | 29.4                          |

### 2019 nitrogen

| Field                       | 2019<br>inorganic<br>nitrogen<br>PPM | Percentage<br>inorganic<br>nitrogen<br>PPM | 2019<br>organic<br>nitrogen<br>PPM | Percentage<br>organic<br>nitrogen<br>PPM | Total 2019<br>nitrogen<br>PPM |
|-----------------------------|--------------------------------------|--|------------------------------------|--|-------------------------------|
| 3E (wheat, no cover crops)  | 53.4                                 | 55.3%                                      | 43.2                               | 44.7%                                    | 96.6                          |
| 3W (wheat, no cover crops)  | 46.7                                 | 55.4%                                      | 37.6                               | 44.6%                                    | 84.3                          |
| 6E (soybean, planted green) | 6.9                                  | 13.6%                                      | 43.7                               | 86.4%                                    | 50.6                          |
| 6W (soybean, planted green) | 4.8                                  | 12.9%                                      | 32.2                               | 86.8%                                    | 37.1                          |
| 10E (perennial)             | 6.3                                  | 12.6%                                      | 43.8                               | 87.4%                                    | 50.1                          |
| 10W (perennial)             | 28.9                                 | 38.0%                                      | 47.2                               | 62.0%                                    | 76.1                          |

### 2020 nitrogen

|  | 2020<br><br>inorganic<br>nitrogen<br>PPM | Percentage<br><br>inorganic<br>nitrogen<br>PPM | 2020<br><br>organic<br>nitrogen<br>PPM | Percentage<br><br>organic<br>nitrogen<br>PPM |      |
|--|--|--|--|--|------|
| 1W (30-inch corn, no cover crop)                           | 14.8                                     | 48.2%  | 16.3                                   | 53.1%  | 30.7 |
| 1E (60-inch corn with perennial cover crop, planted green) | 23.1                                     | 64.9%  | 10.3                                   | 28.9%  | 35.6 |
|  | 19.5                                     | 67.2%  | 7.2                                    | 24.8%  | 29.0 |
|  | 13.1                                     | 57.7%  | 10.9                                   | 48.0%  | 22.7 |
| 7W (spring wheat with cover crop, planted green)           | 12.8                                     | 47.8%  | 14.6                                   | 54.5%  | 26.8 |

In 2020, fields 1 east, 7 east and 7 west were all planted green. They have a higher percentage of the total nitrogen in the organic form, a more stable form of nitrogen. This is a positive for water quality. Fields 1 west, 3 east and 3 west were not planted green. They have a higher percentage of the total nitrogen in the inorganic form. This is a more unstable form of nitrogen and more likely to contribute to water quality concerns.



Soil test samples taken and analyzed in 2021 are as follows:

- **Field 4:** This field received 4 gallons of vermicompost liquid extract at a rate of 4 gallons per acre in the seed trench during planting. It received a follow up foliar application at the V5 stage (details below and photo of foliar application of vermicompost liquid extract on next page)



Ag Testing - Consulting

Account No. : 21172

Plant Analysis Report

FUHRER, JAY  
BURLEIGH CO SOIL CONS DIST  
916 E INTERSTATE AVE STE 6  
BISMARCK ND 58503-0548

Invoice No. : 1349443  
Date Received : 07/22/2021  
Date Reported : 07/26/2021  
Lab Number : 5699

Results For MENOKEN FARM

Location : CORN

Sample ID : 4

Plant Type : Corn

Stage : Tassel

|                    | Result<br>Dry Basis | Sufficiency Levels |     |            |      |
|--------------------|---------------------|--------------------|-----|------------|------|
|                    |                     | Deficient          | Low | Sufficient | High |
| Nitrogen, % N      | 2.688               |                    |     |            |      |
| Phosphorus, % P    | 0.248               |                    |     |            |      |
| Potassium, % K     | 2.82                |                    |     |            |      |
| Calcium, % Ca      | 0.497               |                    |     |            |      |
| Magnesium, % Mg    | 0.293               |                    |     |            |      |
| Sulfur, % S        | 0.178               |                    |     |            |      |
| Zinc, ppm Zn       | 21                  |                    |     |            |      |
| Iron, ppm Fe       | 77                  |                    |     |            |      |
| Manganese, ppm Mn  | 85                  |                    |     |            |      |
| Copper, ppm Cu     | 8.0                 |                    |     |            |      |
| Boron, ppm B       | 22.3                |                    |     |            |      |
| Molybdenum, ppm Mo | 0.20                |                    |     |            |      |



- *Field 4C:* This field did not receive vermicompost liquid extract during planting. In addition, it did not receive a follow up foliar application at the V5 stage (details on next page)



Ag Testing - Consulting

Account No. : 21172

Plant Analysis Report

FUIRER, JAY  
BURLEIGH CO SOIL CONS DIST  
916 E INTERSTATE AVE STE 6  
BISMARCK ND 58503-0548

Invoice No. : 1349443  
Date Received : 07/22/2021  
Date Reported : 07/26/2021

Lab Number : 5700

Results For : MENOKEN FARM  
Location : CORN  
Sample ID : 4C

Plant Type : Corn  
Stage : Tassel

|                    | Result<br>Dry Basis | Sufficiency Levels |     |            |      |
|--------------------|---------------------|--------------------|-----|------------|------|
|                    |                     | Deficient          | Low | Sufficient | High |
| Nitrogen, % N      | 2.403               |                    |     |            |      |
| Phosphorus, % P    | 0.226               |                    |     |            |      |
| Potassium, % K     | 2.83                |                    |     |            |      |
| Calcium, % Ca      | 0.411               |                    |     |            |      |
| Magnesium, % Mg    | 0.261               |                    |     |            |      |
| Sulfur, % S        | 0.150               |                    |     |            |      |
| Zinc, ppm Zn       | 19                  |                    |     |            |      |
| Iron, ppm Fe       | 74                  |                    |     |            |      |
| Manganese, ppm Mn  | 62                  |                    |     |            |      |
| Copper, ppm Cu     | 7.4                 |                    |     |            |      |
| Boron, ppm B       | 18.6                |                    |     |            |      |
| Molybdenum, ppm Mo | 0.49                |                    |     |            |      |

- *Fields 4 and 4C:* Standard soil tests were performed. Field 4 illustrates the impact of microbial nitrogen (concentrated fish emulsion) added to the vermicompost liquid extract, when applied as a foliar. This resulted in approximately 11 units of additional nitrogen (details for field 4 below and field 4C on next page)



Ag Testing - Consulting

Account No. : 21172

FUIRER, JAY  
BURLEIGH CO SOIL CONS DIST  
916 E INTERSTATE AVE STE 6  
BISMARCK, ND 58503-0548

Soil Analysis Report

Results For : MENOKEN FARM  
Location : 4

Invoice No. : 1349352  
Date Received : 07/21/2021  
Date Reported : 07/23/2021

| Sample ID | Soil pH | Modified WDRF BpH | Soluble Salts 1:1 mmho/cm | Excess Lime Rating | Organic Matter LOD-% | KCl Nitrate ppm N | Depth           | Method           | -Ammonium Acetate- |        |        |        | M-3 Sulfate ppm S | -----DTPA----- |        |        |        | Hot Water Boron ppm B | CaNO3 Chloride ppm Cl | Sum of Cations me/100g | % Base Saturation |      |      |      |    |  |      |   |   |    |    |
|-----------|---------|-------------------|---------------------------|--------------------|----------------------|-------------------|-----------------|------------------|--------------------|--------|--------|--------|-------------------|----------------|--------|--------|--------|-----------------------|-----------------------|------------------------|-------------------|------|------|------|----|--|------|---|---|----|----|
|           |         |                   |                           |                    |                      |                   | Nitrate Lbs N/A | Phosphorus ppm P | K ppm              | Ca ppm | Mg ppm | Na ppm |                   | Zn ppm         | Fe ppm | Mn ppm | Cu ppm |                       |                       |                        | H                 | K    | Ca   | Mg   | Na |  |      |   |   |    |    |
| Lab No.   | 1:1     |                   |                           |                    |                      |                   |                 |                  |                    |        |        |        |                   |                |        |        |        |                       |                       |                        |                   |      |      |      |    |  |      |   |   |    |    |
| CORN 60   |         |                   |                           |                    |                      |                   |                 |                  |                    |        |        |        |                   |                |        |        |        |                       |                       |                        |                   |      |      |      |    |  |      |   |   |    |    |
| 78911     | 6.6     |                   | 0.25                      | NONE               | 4.5                  | 4.7               | 9               | 21               | 0 - 6 in           | M-3    |        |        |                   |                | 330    | 2243   | 437    | 26                    | 36.5                  | 1.18                   | 28.5              | 17.3 | 0.48 | 0.91 |    |  | 15.8 | 0 | 5 | 71 | 23 |



Ag Testing - Consulting

Account No. : 21172

FUHRER, JAY  
BURLINGHAM CO SOIL CONS DIST  
916 E INTERSTATE AVE STE 6  
BISMARCK, ND 58503-0548

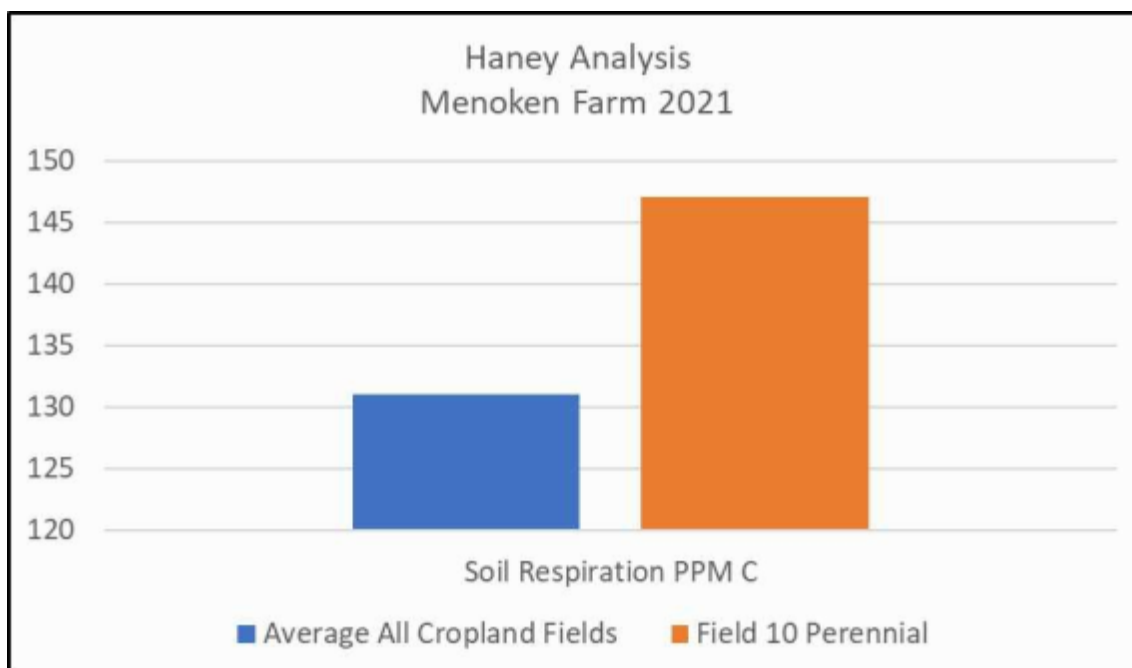
Soil Analysis Report

Results For : MENOKEN FARM  
Location : 4C

Invoice No. : 1349352  
Date Received : 07/21/2021  
Date Reported : 07/23/2021

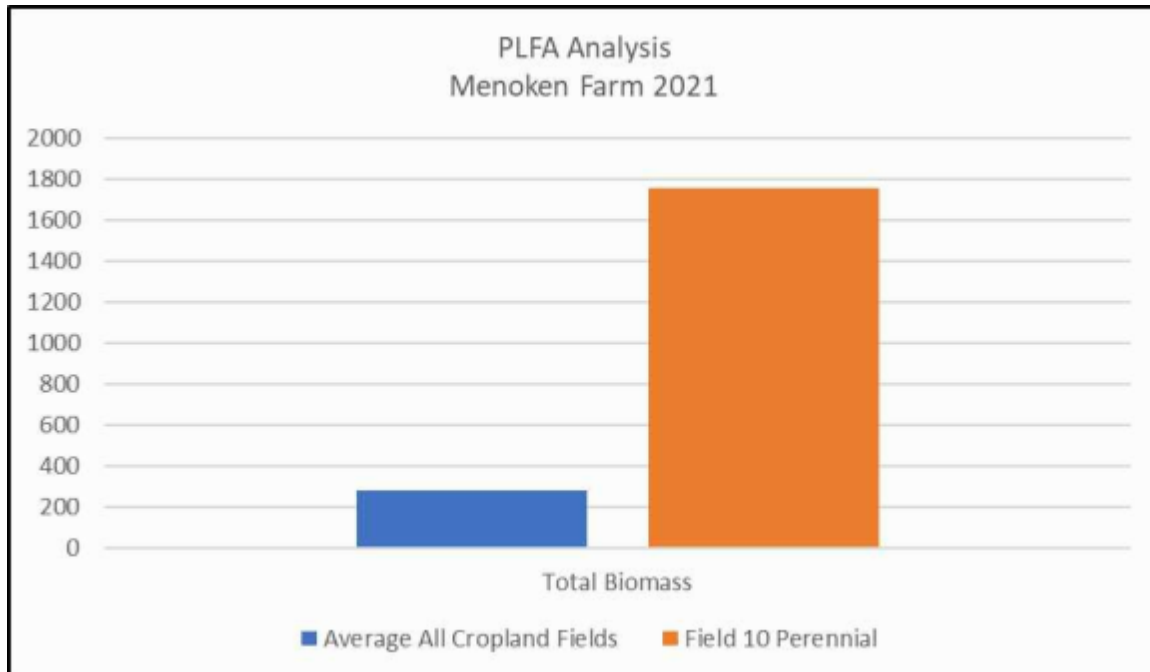
| Sample ID | Soil pH | Modified WDRF | Soluble Salts 1:1 | Excess Lime | Organic Matter | KCl Nitrate | Depth   | Method     | -Ammonium Acetate- |      |     |    | M-3     | -DTPA- |      |      |      | Hot Water | CaNO <sub>3</sub> | Sum of  | % Base |   |    |    |    |
|-----------|---------|---------------|-------------------|-------------|----------------|-------------|---------|------------|--------------------|------|-----|----|---------|--------|------|------|------|-----------|-------------------|---------|--------|---|----|----|----|
| Lab No.   | 1:1     | BpH           | mmol/cm           | Rating      | LOI-%          | ppm N       | Nitrate | Phosphorus | K                  | Ca   | Mg  | Na | Sulfate | Zn     | Fe   | Mn   | Cu   | Boron     | Chloride          | Cations | H      | K | Ca | Mg | Na |
| CORN 80   |         |               |                   |             |                |             | 0-5 in  | M-3        |                    |      |     |    |         |        |      |      |      |           |                   |         |        |   |    |    |    |
| 78912     | 6.4     | 6.9           | 0.18              | NONE        | 4.2            | 3.2         | 6       | 10         | 227                | 2062 | 369 | 15 | 20.4    | 0.05   | 28.6 | 19.7 | 0.47 | 0.70      |                   | 15.3    | 7      | 4 | 67 | 21 | 1  |

Haney Analysis comparisons during drought conditions further supports the value of perennials. The following chart is the average soil respiration of annual crop production fields versus the soil respiration from field 10 perennial.



PLFA Analysis comparison during drought conditions also further supports the value of perennials. The chart on the next page is the average total biomass of annual crop production fields versus the total biomass from field 10 perennial.





■ *Current status:* Complete

**Task 7: Conduct three major educational/demonstration events**

One major workshop/tour will be held each year, for a total of three major events. Infiltration, rainfall simulator, slake, crop and grass root boxes and tabletop runoff demonstrations will be conducted.

■ *Products:* A total of three major education and demonstration events that provide education and training on the management of systems and technology that can be implemented to improve soil health, plant and animal biodiversity, and other practices that ultimately protect and improve water quality.

■ *Accomplishments to date:* Burleigh County SCD planned and held four events during this grant's last reporting period of Sept. 1, 2021, and June 30, 2022. A total of 378 attended these events.

Adding this to the 16 events with 3,185 participants during the period of Aug. 1, 2018, through Aug. 31, 2021, brings the total events under this grant to 20 and the total participants to 3,563.

The 20 total events under this grant are as follows:

1. *Nov. 7 and 8, 2018, Soil Health Summit:* "Regenerating Soil with Diversity" was held at the National Energy Center of Excellence on the campus of Bismarck State College, Bismarck. Featured speakers on the first day included: 1) Loran Steinlage, Iowa farmer; 2) Jeremy Wilson, North Dakota farmer; 3) Dr. Kris Nichols, KRIS Systems Educating and Consulting; 4) Blaine and Kent Schmaltz, North Dakota farmers; 5) Russell Hedrick; 6) Alan Newport, editor of the *Beef Producer Magazine*; and 7) Gabe Brown, North Dakota farmer. Featured speakers on the second day included: 1) Jason Mauck, Indiana

farmer; 2) Jimmy Emmons, Oklahoma farmer; 3) Derek Axten, Saskatchewan farmer; 4) Dr. Jonathan Lundgren, South Dakota farmer and entomologist; 5) Lon Tonneson, editor of the *Dakota Farmer Magazine*; 6) Dr. Dwayne Beck, Dakota Lakes Research Farm and South Dakota State University; and 7) Francis Akolbila, Ghana. Jay Fuhrer, a soil health specialist with NRCS, led Q&A sessions both days. A total of 398 attended the two-day event.

2. *July 11, 2019, Menoken Farm Garden Tour: "Composting & Gardening: Just Do It!"* featured Dr. David Johnson and Hui-Chun Su Johnson of New Mexico. They developed an inexpensive do-it-yourself bioreactor for producing fungal-rich compost for gardens and rangelands. They led an afternoon event on static compost management and compost application. Then, for the early evening session, they were part of five 20-minute rotating learning stations. The other four learning station speakers were Dr. Marko Davinic, soil biology; Keith Knudson, aquaponics; Casey Williams, high tunnels; and Joe Zeleznik, trees and shrubs. New for the 2019 annual garden tour was a children's session from 5:30 to 7:30 p.m. It was led by Nolan Swenson of Burleigh County SCD. A total of 169 attended the 2019 Garden Tour events.
3. *July 23, 2019, Menoken Farm Cover Crop and Grazing Tour: "Crops, Covers & Cows"* was held from 4 to 7 p.m. at Menoken Farm. The three featured speakers were: 1) Steve Groff, who farms in Lancaster County and is the founder of Cover Crop Solutions; 2) Justin Zahradka, a farmer and rancher near Lawton, N.D., who is also a crop consultant; and 3) Aaron Stecker, a farmer and rancher near St. Anthony, N.D., who is also a supervisor for Morton County SCD. A total of 132 attended the event.
4. *Nov. 6 and 7, 2019, Soil Health Summit: "Edible Landscapes"* was held from 9 a.m. to 6 p.m. Nov. 6 and from 9 a.m. to 3:15 p.m. Nov. 7 at the National Energy Center of Excellence on the campus of Bismarck State College. The keynote speaker was Dan Kittredge with the Bionutrient Food Association. Other speakers included Jon Stika, Jonathon Moser, Raychel Santo, Lindsay Rebhan, Lyle Perman, Morgan Jacobs, Lana Shaw, Shanon and Melinda Sims, David Bailey, and Steve Tucker. Speaker panels were held at the end of each day with Nolan Swenson moderating the first day and Darrell Oswald moderating the second day. A total of 135 attended over the two days.
5. *Feb. 25 and 26, 2020, Farming and Ranching for the Bottom Line: "Discover the Triple Bottom Line: Economics, Ecology & Society"* was held from 9 a.m. to 4:30 p.m. Feb. 25 and from 9 a.m. to 4 p.m. Feb. 26 at the National Energy Center of Excellence on the campus of Bismarck State College in Bismarck. Burleigh County SCD staff helps plan and sponsor the second day of this annual conference. They work in collaboration with USDA Agricultural Research Services/Northern Great Plains Research Lab. The 2020 featured speaker was Dr. Fred Provenza, author of the book *"Nourishment: What Animals Can Teach Us about Rediscovery Our Nutritional Wisdom."* Other speakers on Feb. 26 included Dr. David Toledo; John Pfaff; Laura Edwards; Greg Busch and Dr. Jerry Hatfield. A total of 400 attended the event over the two days.



6. *March 3 through 5, 2020, Holistic Management Course:* Joshua and Tara Dukart led this three-day workshop at Menoken Farm. Burleigh County SCD and the North Dakota Grazing Lands Coalition each provided \$100 scholarships for each participant. A total of 36 attended the training.
7. *May 16, 2020, Build-Your-Own Rain Barrel or Compost Tumbler Workshop:* Nolan Swenson of Burleigh County SCD led this event at Menoken Farm. One hands-on session was held in the morning and one in the afternoon. Participants were supplied a 55-gallon plastic barrel and the supplies needed to build either a rain barrel or compost tumbler, which they then took home. Registration was limited due to the Covid-19 pandemic and social distancing was practiced. The event was livestreamed for those who wanted to register and pick up a barrel kit but did not want to attend in person. A total of 24 participants attended the event in person. The rest completed their projects at home. A total of 36 rain barrels were constructed and 16 compost tumblers were constructed.
8. *June 25, 2020, Menoken Farm Garden Tour:* The annual Garden Tour at Menoken Farm featured Jon Stika, author of the book, *"A Soil Owner's Manual: How to Restore and Maintain Soil Health."* Because of the Covid-19 pandemic, registrations were limited and the event was livestreamed for those who could not attend in person. Stika, Jay Fuhrer and Darrell Oswald led a "Walk of Life" event from 3 to 5 p.m. for those who wanted to come early to tour the farm and its fields. The evening session, held from 5:30 to 7:30 p.m., included the topics of: Making garden soil healthy; composting; milpa gardening; and high tunnel production. A total of 90 people attended the 2020 Menoken Farm Garden Tour.
9. *Oct. 9 and 10, 2020, Permaculture Workshop: Focusing on the Home and Homestead:* A total of 25 attended this introductory to permaculture workshop that was held via Zoom from 1 to 5 p.m. Oct. 9 and from 9 a.m. to 4 p.m. Oct. 10. Instructors were Bill and Becky Wilson who created Midwest Permaculture as a hub for education to share with their community and students. Topics covered included: 1) An introduction to ethics and principles; 2) sequential steps and priorities for design; 3) how to assess your property; 4) creative ideas, solutions and examples; and 5) our individual role in creating a more permanent culture. The event was initially scheduled to be held at Menoken Farm. However, the Wilsons did not want to risk traveling with the Covid-19 pandemic.
10. *Feb. 23 and 24, 2021, Farming and Ranching for the Bottom Line:* "Linking Soil to Well-Being" was held via Zoom due to the Covid-19 pandemic. A total of 872 registered for the electronic event. Burleigh County SCD planned and sponsored the second day (Feb. 24) of this event. The five featured speakers Feb. 24 were John Kempf; Derek and Tannis Axten; Chris Teachout; and Darrell Oswald. Kempf is the founder of Advancing Eco Agriculture, a plant nutrition and biostimulants consulting company founded in 2006. His three presentations on Feb. 24 were: 1) Reducing Fertilizer Use; 2) Water Use Efficiency; and 3) Using Inoculants Effectively." The Axtens and Teachout were part of "An Innovative Producer Panel: Bringing Life Back to the Farm Using Bioinoculants." The Axtens are third-generation owners of Axten Farms, a diversified grain farm near

Shenandoah, Iowa, which dates back in his family to 1876. Oswald, a Burleigh County SCD employee, has managed Menoken Farm since 2016. His presentation was titled “What’s Going on at Menoken Farm?”

11. *May 22, 2021, Reconnect With Your Food:* This event was held from 10 a.m. to 3 p.m. May 22, 2021, in Burleigh County with 73 people attending. This event was the first in a four-part food/gardening series planned for 2021. The series featured the following topics: 1) Planning and planting; 2) growing and tending; 3) nutrition; and 4) harvesting and preserving. Speakers and locations for “Reconnect With Your Food” were as follows: Wanda and Dennis Burrer farm near Wing, N.D.; Ella and Nolan Swenson farm near Wing; and Kara and Austin Winkler farm near Menoken, N.D. Bus transportation was provided for attendees.
12. *June 22, 2021, Local Treasures: 2021 Garden Tour:* This event, which was held June 22, 2021, at Menoken Farm, was the second in the four-part food/gardening series. Attendance at the afternoon “Walk of Life” session was 108. Attendance for the evening “Gardening Local Treasures” was 139. Keith Knudson of the Entrepreneurial Center for Horticulture at Dakota College at Bottineau, and Jay Fuhrer led a walking tour of the gardens and trailer rides to the fields for the 2 to 4 p.m. event. The evening event from 5 to 7 p.m. featured four rotating stations that featured the following speakers and topics: 1) Knudson: Summer Horticultural Projects at Dakota College at Bottineau; 2) Lori Martin, Roving Donkey Farm: High-value Crop Production in Protected Environments; 3) Jonathan Moser, Forager Farm: Successional Planting for Constant, Consistent Harvests; and 4) Roberta Thorson, Thorson Gardens: Matching Produce Varieties to your Environment and Business.
13. *July 29, 2021, Crops, Covers & Cows II:* A total of 189 people attended this Menoken Farm Crop, Cover Crop and Grazing Tour at Menoken Farm. The event was from 4 to 7 p.m. (CDT). The five featured speakers were Jimmy Emmons, Steve Kenyon, Chris Teachout, David Bauer and Cody Kologi. Bauer and Kologi are Burleigh County SCD board members. Emmons farms and ranches 2,000 acres near Leedey, Okla. Kenyon operates Greener Pastures Ranching Ltd near Busy, Alberta, Canada. Teachout is a fifth-generation farmer in Southwest Iowa.
14. *Aug. 4, 2021, The Future of Food:* This event was held from 5 to 7:30 p.m. Aug. 4, 2021, at the North Dakota Heritage Center in Bismarck, N.D. A total of 162 attended the event. The three high-profile speakers were Dan Kittredge, Joel Salatin and Mark Schatzker. Kittredge has been an organic farmer for more than 30 years and is the founder and executive director of the Bionutrient Food Association. Salatin raises livestock on his Polyface Farm near Swoope, Va. He has authored 13 books. Schatzker is an award-winning writer based in Toronto. He is the author of “The Dorito Effect: The Surprising
15. *Aug. 26, 2021, North Dakota Conservation Award Tour:* Burleigh County SCD, along with its partners, Morton County SCD and NRCS, helped sponsor the North Dakota Leopold Conservation Award Winner Tour at the Dockter-Jensen Ranch at 1 p.m. Aug.

25. About 90 people attended the event. The featured speaker was Doug Peterson, an NRCS employee in Missouri for more than 32 years. Tour highlights included rotational grazing; crop rotation; no-till and cover crops; and erosion prevention. A dinner was held at 5 p.m. at the Ducks Unlimited Coteau Ranch.

16. *Aug. 26, 2021, Food Preservation Workshop:* A total of 143 people attended the “Food Preservation Workshop” that was held from 5 to 7 p.m. Aug. 26, 2021, at Menoken Farm. The three speakers and their presentation titled were: 1) Sue Balcom, “Pressure Canning vs. Water Bath Canning;” 2) Diane Schmidt, “How to Make Sauerkraut;” and 3) Shaundra Ziemann-Bolinske, “Freezing & Drying Fruits and Vegetables and the Latest and Greatest in Canning.” Balcom and Schmidt are longtime gardeners and farmers market sellers and Ziemann-Bolinske works is an NDSU Extension agent for Burleigh
17. *Oct. 19-21, 2021, Holistic Management School:* A total of 25 people attended “Finding the Right Balance: Managing Land, Wealth & People for Success” led by Joshua and Tara Dukart of Seek First Ranch in western North Dakota. Event sponsors were Burleigh County SCD and the North Dakota Grazing Lands Coalition. Each contributed \$100 toward the \$400 per person tuition. The three-day event was held at Menoken Farm.
18. *Feb. 17, 2022, Gardening Basics:* A total of 33 attended this event, which was planned and held in partnership with NDSU Extension Service. Speakers and their topics were: Jaden Deckert, no-till gardening; Kelsey Deckert, starting seeds; and Tom Kalb, seed cultivars in North Dakota. Jaden Deckert used the rainfall simulator as part of his presentation. Seed trays and seeds were given out to attendees. This event was the first in a four-part Gardening 101 series for 2022.
19. *Feb. 22 and 23, 2022, Farming & Ranching for the Bottom Line:* The theme for this event was “Building Soil Health: Processing the Microbiome.” A total of 280 people participated in the event (137 in person and 143 online). The hybrid event was held at the National Energy Center of Excellence on the Campus of Bismarck State College. The keynote speakers for the two-day workshop were Joel Williams and Paulo Carvalho. Williams is an independent plant and soil health educator with Integrated Soils He focuses on integrated approaches to sustainable food production. Carvalho is a researcher of soil-plant-animal relationships with the Animal Science Research Program at the Federal University of Rio Grande do Sul, Brazil.
20. *May 5, 2022, Garden Improvement:* This event was held at the Burleigh County Extension office with 40 in attendance. Speakers and their topics were: Jayden Deckert, no-dig potatoes and potato towers; Kelsey Deckert, how to be successful with gardening; Tom Kalb, natural and safe pesticides; and Sarah Hamilton Buxton, attracting pollinators. This event was the second in a four-part Gardening 101 series for 2022.

■ *Current status:* Complete

**Task 8: Arrange and host 30 summer tours**

We will plan/carry out 10 summer tours per year at Menoken Farm. These workshops/tours are primarily for farmers and ranchers and include all the demonstrations listed in Task 7. These tours will include a grazing component, which focuses on the planting green project.

■ *Products:* A total of 30 completed summer tours

■ *Accomplishments to date:* During the entire grant period of Aug. 1, 2018, and June 30, 2022, a total of 72 tours were held with 1,519 receiving training. Of these tours, 10 occurred in 2018 with 209 in attendance; 26 occurred in 2019 with 549 in attendance; six occurred in 2020 with 45 in attendance; 22 occurred to date in 2021 with 566 in attendance; and 8 occurred to date in 2022 with 150 in attendance.

| 2018 date                   | Tour group(s) and contact person (if available)                             | Number attending |
|-----------------------------|---|------------------|
| 8-1-18                      | Rangeland management meeting with Jim Gerrish, Greg Judy and Burke Teichert | 18               |
| 8-7-18                      | South Africa farmer group   | 15               |
| 8-8-18                      | Wildlife Society  | 20               |
| 9-10-18                     | Argentina farmer group, Francisco Oliverio                                  | 15               |
| 9-12-18                     | Missouri NRCS, Warren Cork  | 6                |
| 9-12-18                     | Iowa NRCS, Rick Bednarek  | 32               |
| 9-20-18                     | BSC soil class, Perry Sullivan and Kyle Thomson                             | 40               |
| 9-21-18                     | Australia group, Jules and Merrity Schmidt                                  | 3                |
| 10-3-18                     | Chamber Leadership Program, Leslie Percy                                    | 20               |
| 10-4-18                     | BSC soil class  | 40               |
| <b>2018 TOTAL ATTENDEES</b> |   | <b>209</b>       |

| 2019 date                   | Tour group(s) and contact person (if available)    | Number attending |
|-----------------------------|--|------------------|
| 3-21-19                     | Claire Hague and guest                             | 2                |
| 4-15 to 4-17                | Biochar training, ND Forest Service and others     | 18               |
| 5-9-19                      | Fort Berthold Community College                    | 4                |
| 6-4-19                      | Remi, France                                       | 1                |
| 6-11-19                     | Extension agents, Chris Augustin                   | 19               |
| 6-13-19                     | ND and U.S. Forest Service                         | 13               |
| 6-17-19                     | Group from Mexico                                  | 11               |
| 6-18-19                     | Turner farmer group from Montana, Patrick Kimmel   | 25               |
| 6-19-19                     | Anne Plante, Minneapolis                           | 1                |
| 6-26-19                     | Good Bugs meeting, Lena Bohm                       | 30               |
| 7-2-19                      | UK farmer group. Steve Cann                        | 24               |
| 7-8-19                      | Divide, Williams and Burke counties, Keith Brown   | 60               |
| 7-9-19                      | RC&D board   | 8                |
| 7-9-19                      | North Central SARE, Karl Hoppe                     | 40               |
| 7-15-19                     | Black Leg Ranch interns                            | 3                |
| 7-15-19                     | EPA staff, Greg Sandness                           | 6                |
| 7-24 and 7-25               | Becker County, MN, farmer group                    | 55               |
| 7-26-19                     | ND State Horticultural Society                     | 88               |
| 8-5-19                      | Lemmon, SD, group, Michael Van Beek                | 8                |
| 8-6-19                      | Australian farmer group, Grahame Rees              | 22               |
| 8-19-19                     | South Dakota farmer group, Terry and Mary Ness     | 12               |
| 8-23-19                     | Wisconsin group, Brian Briski                      | 12               |
| 8-27-19                     | Ellendale group, Tokina McHarry                    | 10               |
| 9-11-19                     | Redfield, S.D., group                              | 10               |
| 9-25-19                     | ND Bankers Association                             | 17               |
| 10-10-19                    | Bismarck State College students, Dr. Marko Davinic | 50               |
| <b>2019 TOTAL ATTENDEES</b> |  | <b>549</b>       |

| 2020 date | Tour group(s) and contact person (if available) | Number attending |
|-----------|---|------------------|
| 1-22-20   | Hungarian farmer group and green cover seed     | 6                |
| 1-29-20   | U.S. Fish & Wildlife, Long Lake branch          | 6                |
| 7-10-20   | Britt and Jon Hemme, Preson LaDuke, Missouri PM | 2                |
| 8-25-20   | Iowa Soil Health Specialist Hillary Olson group | 20               |
| 8-27-20   | FAARMS group                                    | 9                |
| 9-2-20    | Brian Maddock                                   | 2                |
|           | <b>2020 TOTAL ATTENDEES</b>                     | <b>45</b>        |

| 2021 date  | Tour group(s) and contact person (if available)               | Number attending |
|------------|---|------------------|
| 2-16-21    | Minnesota Land Stewardship (virtual)                          | 110              |
| 2-17-21    | Nutrient management training, Watford City field office staff | 7                |
| 3-5-21     | Riobox webinar  | 15               |
| 4-6-21     | Garden series (1 of 3) Alberta, Canada (virtual)              | 50               |
| 4-13-21    | Garden series (2 of 3) Alberta, Canada (virtual)              | 50               |
| 4-20-21    | Garden series (3 of 4) Alberta, Canada (virtual)              | 50               |
| 6-2-21     | Climate Change Task Force, Wisconsin                          | 20               |
| 6-2-21     | Independent Community Bankers Association                     | 15               |
| 6-11-21    | Wild Roots Nature Group                                       | 5                |
| 6-14/15-21 | Wild Roots Nature Group                                       | 10               |
| 6-17-21    | Independent Community Bankers Association                     | 15               |
| 6-29-21    | Indiana couple  | 2                |
| 7-27-21    | Soil Health Division film crew                                | 5                |
| 8-3-21     | Spink County South Dakota farmer group                        | 20               |
| 8-5-21     | Teacher group   | 15               |
| 8-11-21    | North Dakota Game & Fish Wildlife Division                    | 60               |
| 8-18-21    | FAARMS  | 15               |
| 9-16-21    | Montana Soil and Water Conservation Society                   | 20               |
| 10-6-21    | Ag Day for Leadership Bismarck/Mandan                         | 12               |
| 10-12-22   | Extension Service   | 20               |
| 10-23-22   | EPA, Radhika Fox  | 40               |
| 12-22-22   | N.D. Dept. of Environmental Quality Carbon Initiative         | 10               |
|            | <b>2021 TOTAL ATTENDEES</b>                                   | <b>566</b>       |

| 2022 date         | Tour group(s) and contact person (if available) | Number attending |
|-------------------|---|------------------|
| 1-27-22           | Denmark/Romania                                 | 15               |
| 2-15-22 & 2-16-22 | NRCS cultural resource training                 | 30               |
| 3-2-22            | Western Scout School                            | 25               |
| 5-15-22           | David and Nancy Williams, Nebraska              | 2                |
| 5-18-22           | Bismarck State College Ag Academy, Shawn Brink  | 56               |
| 6-9-22            | Chrisof Just group                              | 5                |
| 6-14-22           | FAARMS Tour                                     | 15               |
| 6-30-22           | Boise, Idaho, couple                            | 2                |
|                   | <b>2022 TOTAL ATTENDEES</b>                     | <b>150</b>       |

■ *Current status:* Complete

**Task 10: Produce six educational videos**

We will work with a local video company to produce three short planting green teaching videos and videos of the three annual major workshops. These videos will be posted on YouTube and the Web sites of Burleigh County SCD, Menoken Farm, the North Dakota Department of Agriculture/Division of Water Quality, NRCS and others.

■ *Products:* Six professionally produced videos posted on YouTube and Web sites

■ *Accomplishments to date:* The three planting green teaching videos are now complete. Two planting green videos were shot in August 2020 with Dana Fletcher, who farms near Courtney, and Tony Fisher, who farms near Ypsilanti. The third planting green video was shot in 2021 with Robert Heidrich, who farms near Strasburg. The three edited videos, titled “The Benefits of Planting Green,” are edited and posted on the Menoken Farm Web site at <https://menokenfarm.com/videos>

A total of 78 videos from 13 of the major educational events have been professionally recorded and edited and are posted on YouTube and the Menoken Farm Web site at [www.menokenfarm.com](http://www.menokenfarm.com) (click on the “Education & Resources” tab in the upper right corner and then choose “Videos”). They are as follows:

- There are **17** videos posted on YouTube and the Menoken Farm Web site at <https://menokenfarm.com/2018-soil-health-summit-regenerating-soil-with-diversity/> from the featured speakers and the two Q&A sessions during the Nov. 7 and 8, 2018, Soil Health Summit. The 15 speaker videos are of the presenters listed previously in the major educational event summary.
- There are **six** videos from the July 22, 2019, Menoken Farm Garden Tour. They include two videos of the featured speakers, Dr. David Johnson and Hui-Chun Su Johnson of New Mexico. The other four videos are of the learning station speakers, Dr. Marko Davinic, Keith Knudson, Casey Williams and Joe Zeleznik.
- There are **six** videos as part of the July 23, 2019, Menoken Farm Cover Crop and Grazing Tour. The link is [www.menokenfarm.com/crops-covers-and-cows/](http://www.menokenfarm.com/crops-covers-and-cows/). The first video features interviews with the three featured speakers, Steve Groff, Justin Zahradka and Aaron Stecker. This video is about 25 minutes long. Subjects of the other five videos include: Animal impact on the Menoken Farm fields; continuous and no-till wheat fields; Roundup-ready corn fields; and warm-season cover crops.
- There are **10** videos from the Nov. 6 and 7, 2019, Soil Health Summit (Edible Landscapes) on the Menoken Farm Web site. Two of the videos are from each day’s speaker panel. One is moderated by Nolan Swenson and one by Darrell Oswald. The other eight videos feature the following speakers: 1) Dan Kittredge (part 1); 2) Dan Kittredge (part 2); 3) Morgan Jacobs; 4) Jon Stika; 5) Steve Tucker; 6) Lyle Perman; 7) Shanon and Melinda Sims (part 1); and 8) Shanon and Melinda Sims (part 2).
- There are **nine** videos from the Feb. 25 and 26, 2020, Farming & Ranching for the Bottom Line workshop. Videotaped speakers are: 1) John Pfaff; 2) Dr. Tom Rabaey; 3) Dr. Mike Grusak; 4) Dr. Gregory Lardy and Dr. John McEvoy; 5) Dr. Abbey Wick; 6) Dr. Fred Provenza (part 1); 7) Dr. Fred Provenza (part 2); 8) Greg Busch; and 9) Dr. Jerry Hatfield.
- There are **four** videos from the May 16, 2020, Build-Your-Own Rain Barrel or Compost Tumbler Workshop. In addition to the livestream video from the morning and afternoon sessions, both sessions were also videotaped, and the footage was edited and posted on the the Menoken Farm Web site.
- There are **three** videos from the June 25, 2020, Menoken Farm Garden Tour. These were also livestreamed the day of the event for those who were unable to attend in person due to the Coronavirus pandemic and social distance guidelines. The videos feature main speaker Jon Stika and Darrell Oswald of Burleigh County SCD/Menoken Farm.



- There are **two** new videos from the Feb. 23 and 24, 2021, Farming and Ranching for the Bottom Line
- There are **four** videos from the June 22, 2021, Local Treasures (Menoken Farm Garden Tour). The videos are of each of the four main speakers: 1) Roberta Thorson; 2) Lori Martin; 3) Keith Knudson; and 4) Jonathon Moser.
- There are **four** videos from the July 29, 2021, Crops, Covers & Cows II event. The videos are: 1) Field tour one; 2) field tour two; 3) field tour three; and 4) field tour four.
- There are **four** videos from the Aug. 4, 2021, Future of Food. They are: 1) Dan Kittredge; 2) Joel Salatin; 3) Mark Schatzker; and 4) questions and answers with Kittredge, Salatin and Schatzker.
- There are **three** videos from the Aug. 26, 2021, Food Preservation Workshop. The videos are of each of the three main speakers: 1) Sue Balcom; 2) Diane Schmidt; and 3) Shaundra Ziemann-Bolinske.
- There are **six** videos from the Feb. 22 and 23, 2022, Farming & Ranching from the Bottom Line. They are: 1) Michael Larson; 2) Joel Williams, What's new in soil biology and strategies to improve it; 3) Joel Williams, Building SOM with roots, exudates and microbes; 4) Speaker panel and wrap-up; 5) Joel Williams, Integrating minerals, microbes and carbon; and 6) Bryan Jorgensen

In addition to these 78 videos, a total of seven podcasts have also been recorded and posted on the Menoken Farm Web site at <https://menokenfarm.com/podcast/>. The podcasts, all hosted by Jay Fuhrer, are: 1) Integrating cover crops into cropping with Steve Groff; 2) bringing soil back to life with Dr. David Johnson and Hui-Chun Su Johnson; 3) restoring a Missouri landscape with Greg Judy; 4) grazing cover crops with Ken Miller; 5) using technology to measure nutrient density with Dan Kittredge; 6) intercropping with Lana Shaw; and 7) long live the soil with Jimmy Emmons

■ *Current status:* Complete

**Task 11: Produce one summary of the results and benefits of planting green and maintain the Menoken Farm Web site/You Tube channel**

We will write copy for a planting green informational brochure, which we will then have designed and printed by a local print shop for distribution throughout North Dakota. The new Menoken Farm Web site, [www.menokenfarm.com](http://www.menokenfarm.com), will be updated regularly and the planting green summary, videos and other resulting products from this project will be posted on the site.

■ *Products:* One summary on the results of this project and the benefits of planting green and the maintenance of the new stand-alone Web site for Menoken farm that was created in 2017 to reach the Menoken Farm target audience

■ *Accomplishments to date:* Jay Fuhrer has completed a summary on the results of this project and the benefits of planting green. The summary is included as Appendix A. The Menoken Farm Web site has been continuously updated to include numerous educational videos, podcasts and articles.

The Menoken Farm Web site/You Tube channel now has 4,636 subscribers, up from 3,973 subscribers at the end of August 2021.

Channel views during this last reporting period were 71,916. When combined with the 513,214 channel views from Aug. 1, 2018, to Aug. 31, 2021, the total channel views during this grant were 585,130.

The majority of the channel views throughout the entire grant period came from the United States, with 62.1 percent. Other top viewing counties include Canada, Australia and the United Kingdom and South Africa.

The top viewed videos during Aug. 1, 2018, to June 30, 2021, were: 1) Greg Judy Feb 2019; 2) RSWD Gabe Brown 2018; 3) Grasslands, Livestock & Hope with Allan Savory; 4) Black Leg Ranch Tour with Allan Savory; 5) Dr. David and Hui Chun Su Johnson; and 6) Joel Salatin 2018. The average view time was 20:59. The top viewer age category was 35-44 at 29.8 percent. Other top age categories are 25-34 at 23.4 percent; 45-54 at 22.1 percent; and 55-64 at 15.5 percent.

The top viewed videos during this grant's final period of Aug. 1, 2021, and June 30, 2022, were: 1) Greg Judy Feb 2019; 2) Dr. David and Hui Chun Su Johnson; 3) Grasslands, Livestock & Hope with Allan Savory; 4) Future of Food Joel Salatin; 5) RSWD Babe Brown 2018; and 6) Joel Salatin 2018. The average view time was 21:41. The top viewer age category was 35-44 at 33.4 percent. Other top age categories are 25-34 at 21.1 percent; 45-54 at 20.8 percent; and 55-64 at 13.2 percent.

■ *Current status:* Complete

### **Local Comments and Recommendations:**

Burleigh County SCD continues to design and implement a planting green scenario that integrates cover crops and livestock into simplified crop rotations. The cash crops planted green or growing with green covers continue to show promise as we tweak the methodology. After 2021 was unusually dry, it seemed 2022 would follow suite. However, early 2022 spring rains brought promise and optimism to our seeded cash crop and cover crops.

Lack of armor on the surrounding area brought wind erosion concerns in the spring. The Menoken Farm fields with cover crops showed no or very little signs of wind erosion, proving—once again—that armor is vitally important to soil health improvement. A sample of some of the observations that took place on the Menoken Farm fields:

- Fields 4,5,6 and 7 were all planted to 60" corn. A low carbon, high legume component cover crop was seeded at approximately V3 between the rows. The cover crop sporadically emerged but suffers from drought-like conditions. The corn has held its own in spite of the lack of moisture. We will be harvesting the corn in early October and hope for 60 to 65 bushels/acre. The grazing of the corn residue and cover crop material will provide an excellent opportunity for livestock integration and increased profitability. Next year's corn will be slid over 30" and placed right in the middle of

this year's cover crop, creating another excellent learning and demonstration opportunity. All these fields continue to be monitored and information gathered to provide content for our educational events and tours.

- Field 9 cereal rye harvest showed promise for the use of winter annual rye and the flexibility it provides. Field 9 was chosen as the field to let develop and take to harvest. The field yielded almost 60 bushels/acre and will provide seed for Menoken Farm. A cover crop was seeded right after harvest but has been slow to develop because of extremely dry conditions.
- Field 8 implemented proven methodology of planting soybeans into standing cereal rye and then terminating the rye. Despite excessively dry conditions, the soybeans will have a conservative yield and be profitable.

Burleigh County SCD's planting green project continues to be monitored, evaluated and shared as part of the Menoken Farm soil health educational program. The goal of integrating cover crops and livestock into simple crop rotations to improve water quality and water use efficiency continues. The Planting Green Project has shown alternative options for cover crop implementation and all the accompanying positive attributes.

## Appendix A

Planting Green – Menoken Farm

6/10/2022

| Field   | 1 – Dead Litter<br>No-till Oat  | 2 – Perennial Pasture<br>Managed Grazing | 8 – Planting<br>Green/NT Soybean |
|---|---------------------------------|--|----------------------------------|
| Inorganic N ppm                               | 14                              | 4  | 7                                |
| Total N ppm                                   | 34                              | 27                                       | 26                               |
| Water Stable<br>Aggregates (Mod)%             | 52                              | 53                                       | 69                               |
| Soil Respiration<br>CO <sub>2</sub> -C ppm C  | 107                             | 60                                       | 73                               |
| Total Living Microbial<br>Biomass (PLFA) ng/g | 5530                            | 5391                                     | 5543                             |
| Functional Group<br>Diversity Index           | 1.308 Slightly Above<br>Average | 1.246 Average                            | 1.414 Good                       |
| Protozoa %                                    | 0                               | 0  | 0.81                             |
| Total Fungi %                                 | 4.9                             | 3.7                                      | 5.12                             |

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Source: Ward Laboratories, Inc

The 2022 soil results continue to support the Planting Green benefits. Field 8 Inorganic N is approximately half of the N available in Field 1 Dead Litter No-till, with Field 2 Pasture having the lowest level of inorganic N available at one time. Supporting the water quality concerns.

Water Stable Aggregates was added in 2022, with Field 8 building the most aggregates. Likely due to the cover crop available immediately in the spring.

The Total Living Microbial Biomass differed little between the three fields. However, the fields start to separate with the Functional Group Diversity Index being stronger in the Planting Green field 8 with increases in Protozoa and Total Fungi.

The Planting Green concept has potential to establish cover crops in a Northern Plains cropping system. Primarily with a low carbon legume cash crop, such as soybean. The Planting Green grant concentrated on soybean into an actively growing cereal rye cover crop. Crops other than soybean would likely require earlier termination and/or different cover crop mixtures

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## What is Planting Green?

The concept of planting an annual cash crop into a live, standing, green, cover crop is relatively new. The concept has the potential of implementing cover crops into low crop diversity cropping systems in the Northern Plains, which typically have a cold and wet, spring environment. Initially, cereal rye would be seeded immediately after harvest of the cash crop. Broadcasting or interseeding a cover crop earlier into the growing cash crop, may also be an option. Planting Green would concentrate on spring establishment of soybean into an actively growing and green cover crop.

## What are the benefits of Planting Green?

Erosion Control: Providing live soil armor to reduce wind and water erosion, especially during the critical spring period.

Salinity Management: Growing out our water through green plant transpiration with a salt tolerant cover crop in lieu of soil evaporation.

Water Quality: Securing post-harvest inorganic nutrient in a green plant, and released for cash crop uptake when the cover crop is terminated.

Subsurface Water Drainage: As an alternative to tile drainage, the cover would help utilize excess water in wet years and be managed with earlier termination during dry years.

Improved Trafficability: Fields with green cover crops actively growing have more load bearing capabilities; assisting spring seeding operations in wet springs.

Increase Crop Diversity: A corn – soybean crop sequence consists of two crop types; a warm season grass and a warm season broadleaf. Adding cereal rye, a cool season grass, increases crop diversity from

two crop types to three crop types; which in turn provides additional pest management and crop rotation benefits.

Less Hairpinning: Greater ease of seed soil contact for planting operations.

Livestock Integration: Creates a window of opportunity to return livestock to the landscape.

Soil Health Benefits: Green cover crops give us the opportunity to harvest additional CO<sub>2</sub>. Providing the soil food web with additional nourishment to complete their soil services; such as cycling nutrients, building soil aggregates, improving infiltration, storing additional water, increasing soil organic matter, etc.

Weed Suppression: Cereal rye is known to suppress weeds and improve herbicide resistant weed control.