PROTECTING THE GREAT BASIN:
REGENERATVIE AGRICULTURE IN THE GENESEE RIVER WATERSHED

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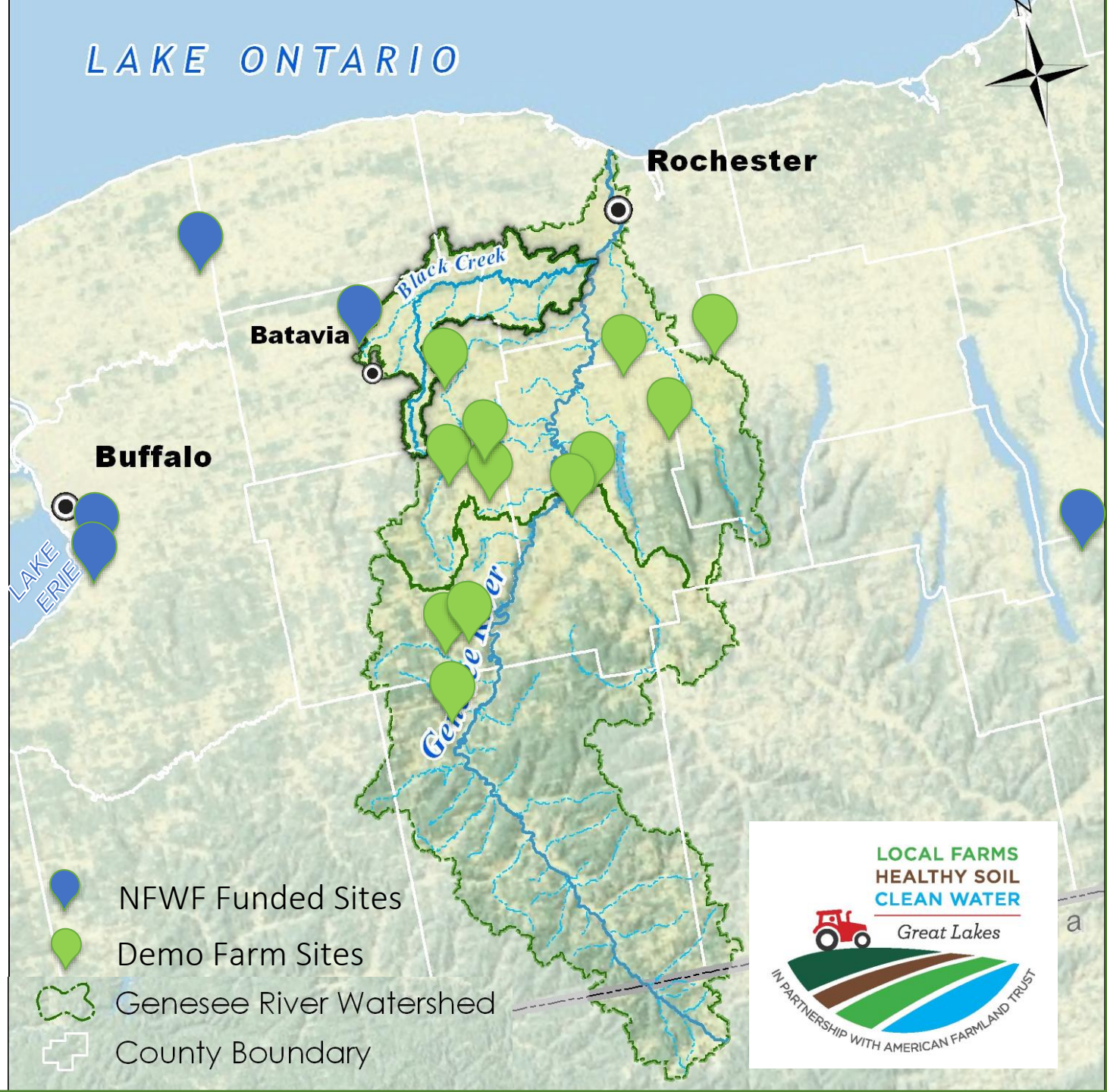
Senior Agricultural Specialist
New York

October 18, 2023

American Farmland Trust

Genesee River Demo Farm Network

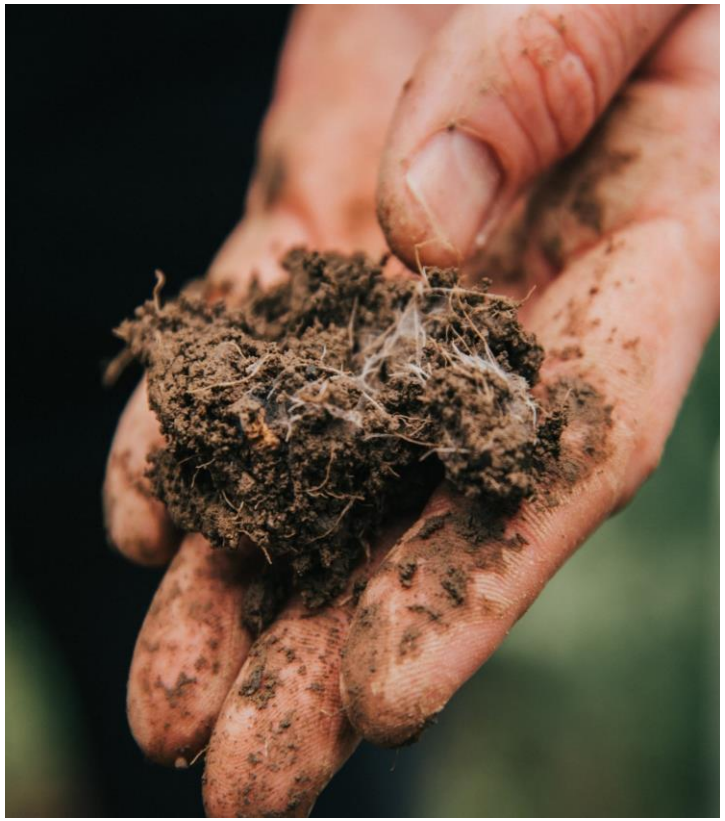
9 Dairies (1 organic, 1 goat)
6 Cash/Grain Farms
2 Vegetable Farm (organic)
51,856 acres
15,700 head livestock



Genesee River Watershed Demonstration Farm Network

LOCAL FARMS
HEALTHY SOIL
CLEAN WATER
Great Lakes
IN PARTNERSHIP WITH AMERICAN FARMLAND TRUST

- Learn from local farmers with successful soil health implementation
- Learn about changes in economic benefits and costs from their real-life experiences
- Learn about observed changes in soil quality like erosion or water runoff
- Learn how to integrate into current system



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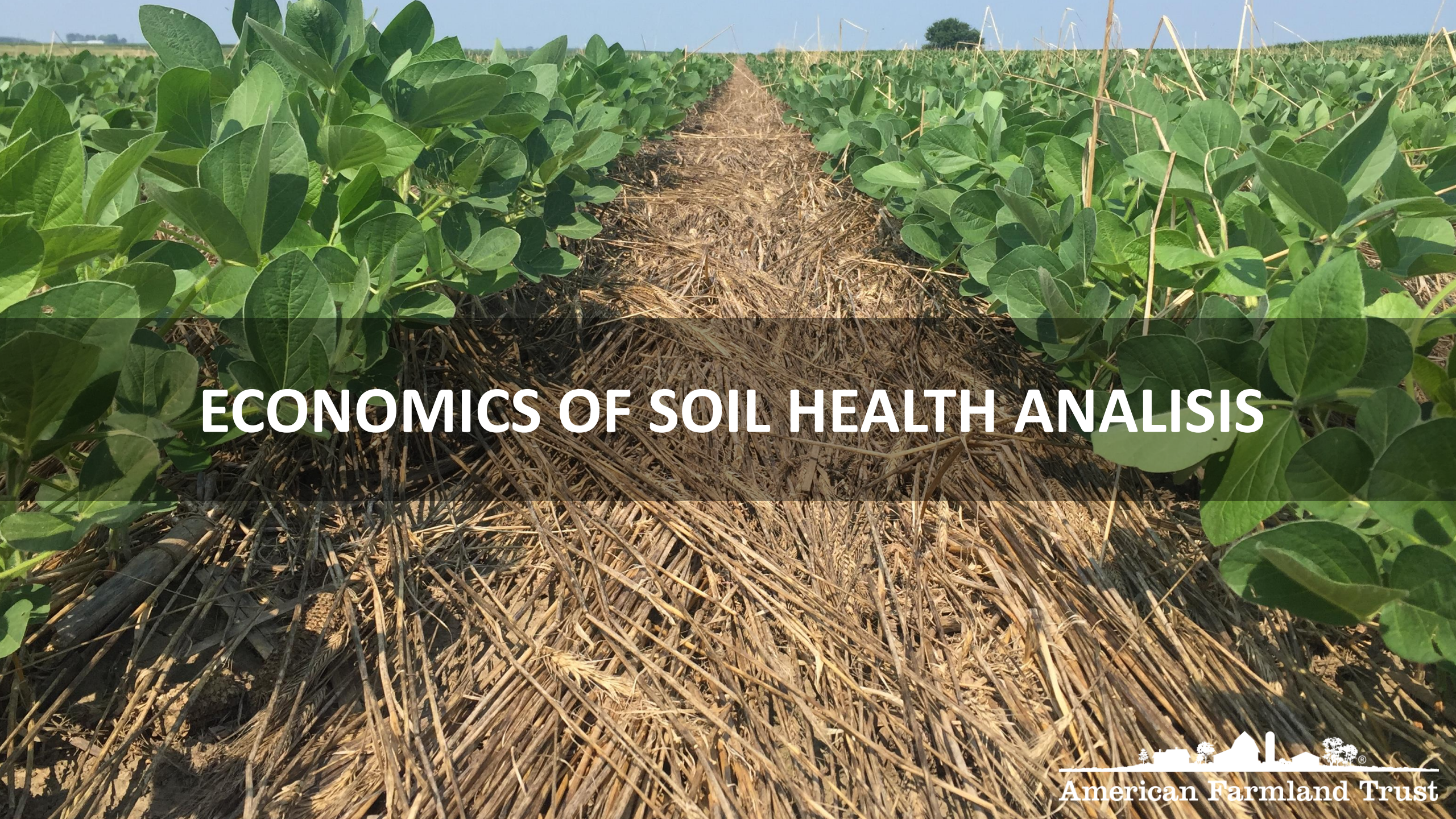
Key Components of Demo Farm Network

- Farmer-led research
- Farmer-to-farmer learning; outreach
- On farm field trials, replicated 4 times
- Farmer provides historic economic and field data, yield
- Farmer participation payments
- Farmer delivered conservation activities
- Net returns guarantee payments for yield losses
- Incentive payments for conservation on rented lands
- AFT helps with plot design, data collection and analysis
- AFT collaborates with partners for data collection, outreach and education



ECONOMICS OF SOIL HEALTH ANALISIS

American Farmland Trust

JULY 2019

Soil Health Case Study

Jay Swede, Gary Swede Farm LLC, NY

Introduction

Jay Swede, his father Gary, and his brother Ryan farm 4,500 acres of cropland on rolling terrain in northwestern New York. The farm splits the acreage among three rotations: grains, vegetables, and feed grown for a 2,000-cow dairy partnership. The rotations are moved throughout all 4,500 acres. Although they are using soil health practices on all crops, for simplicity's sake this study focuses on the 1,500-acre dairy rotation that includes 1-year sweet corn, 3-years alfalfa, 1-year corn silage or corn for grain.

In 2005, Jay tried strip-till to address soil compaction and erosion and to reduce costs. The Swedes began with 100 acres of sweet corn and grain corn but struggled getting the seed placed in the center of the strip. This led them to invest in autosteer in the second year and a satellite-based navigation system in the third year to guide the planter. In just a few years, they were strip-tilling all 1,500 acres in the dairy rotation.

Rye after corn silage has been a popular cover crop in New York, and the Swede farm was no exception. Jay moved to planting oats instead around the same time he switched tillage operations. Oats fit better into their new system and rye often got out of control in the spring, whereas oats die over the winter. However, oats can get too big, sealing the ground in the spring and keeping the soil excessively wet. Jay addressed this by reducing the seed population at planting and adding radishes and wheat to deal with erosion and compaction. Currently, Jay plants 450 acres of cover. He drills a blend of oats and radishes in two rows of strip-till strips, then goes back and drills the wheat in the other two rows. Having the oats between wheat helps manage the large root mass of wheat, which can get in the way of cash crop seed placement.

When the Swedes joined the dairy partnership in 2010, they began applying manure through injection into the soil or top spreading onto the cover crops according to their Comprehensive Nutrient Management Plan. They are accounting for nitrogen and phosphorus in the manure, seeing better nutrient efficiencies due to injection, and putting less nitrogen on upfront by using a split application. More recently, they started using variable rate nutrient application and Adapt-N, a precision nitrogen recommendation tool for corn. Their yields have increased over the years as a result, despite using the same amount of nitrogen.

Soil Health, Economic, Water Quality, and Climate Benefits

Today, Jay uses strip-tillage, cover cropping, and nutrient management on his 600 acres of sweet corn and corn silage. He also uses reduced tillage on the 300 acres of alfalfa he plants each year. Because the alfalfa is in for three years, it makes up the remaining 900 acres in the dairy rotation. These changes have led to many benefits. According to farm records, Jay's sweet corn yields are up by over 31%, and corn silage yields have increased by more than 36% since 2005. Jay believes half of those increases (or about $72 per acre) are attributable to his soil health practices.

The Swedes eliminated three passes by strip-tilling their corn. This means less compaction,

Farm at a Glance

COUNTY: Genesee County, NY

WATERSHED: Genesee River & the Great Lakes Basin

CROPS: Corn silage, grain corn, sweet corn, wheat, alfalfa & vegetables

FARM SIZE: 4,500 acres total, 1,500 dairy rotation

SOILS: Clay, loamy & gravely soils on flat & rolling hills

SOIL HEALTH PRACTICES: No-till, strip-till, cover crops & nutrient management

USDA United States Department of Agriculture Natural Resources Conservation Service

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Jay Swede, Gary Swede Farm LLC, NY

increased water infiltration, and savings in fuel, labor, and machinery maintenance. When combined with reduced tillage for his hay crop, Jay's savings average about $23 per acre. However, he spends about 10 hours each year setting up his corn planter to handle residue from the previous crop.

Despite sizable upfront costs for cover ($51 per acre), Jay thinks it's worth it because it reduces compaction and absorbs nutrients from fall applied manure. Cover also increases soil organic matter. This cost is offset by Jay's nutrient management activities that save him $41 per acre for purchases of phosphorus and potassium. Keeping the soil covered and minimizing tillage has also reduced erosion by nearly two tons per acre. The value of the nutrients in the soil saved is over $2 per acre (NRCS, 2009).

Jay enhances his knowledge of soil health practices by spending about 10 hours a year attending conferences and field days and meeting with ag consultants.

To estimate the water quality and climate benefits experienced on one of Jay's 25-acre fields, USDA's Nutrient Tracking Tool was used and found that Jay's use of strip-till, cover crops, and nutrient management reduced N, P, and sediment losses by 40, 92, and 96% respectively. On the same field, USDA's COMET-Farm Tool estimates that Jay's soil health practices resulted in a 560% reduction in total greenhouse gas emissions, which corresponds to taking three cars off the road.

Partial budgeting analysis was used to estimate the benefits and costs of adopting no-till and strip-till, cover crops, and nutrient management for the Swede Farm. The study limited its focus to variables affected by the adoption of these soil [illegible] practices. The table below [illegible] a summary of these economic effects. Jay improved his bottom line by $55 per acre and by $82,257 on the 1,500 acres in this study by adopting the soil health practices.

Closing Thoughts

"In a recent wet year, the best corn was where the cover crops were," Jay says. While still learning, Jay feels that he has hit his stride with the soil health practices he's adopted and is seeing great results from relatively minor changes to his operations. "The second year we did strip-till, even though the corn was only 8" tall, we had roots going down about a foot." He says his ground is more "workable," and he has observed better infiltration and decreased runoff and erosion in his fields following heavy rains. He also believes he has improved his bottom line by reducing his operating costs, tightening up his management of nutrients, and producing [illegible] yields.

Economic Effects of Soil Health Practices on Gary Swede Farm, LLC (2018)

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Yield Impact Due to Soil Health Practices	$71.95	600	$43,168
Total Increased Income			**$43,168**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Reduced Machinery Cost due to Reduced Tillage	$23.43	1,500	$35,152
Nutrient Savings due to Nutrient Mngmnt.	$40.65	600	$24,390
Value of Decreased Erosion due to Soil Health Practices	$2.25	1,500	$3,369
Total Decreased Cost			**$62,911**
Total Increased Net Income			$106,079
Total Acres in the Study Area			1,500
[illegible] Acre Increased Net Income			$71

Decreases in Net Income

Decrease in Income

ITEM	PER ACRE	ACRES	TOTAL
None Identified			$[illegible]
Total Decreased Income			**$0**

Increase in Cost

ITEM	PER ACRE	ACRES	TOTAL
Cost of Setting up Planter to Handle Residue	$0.72	600	$432
Cover Crop Costs	$51.00	450	$22,950
Residue and Tillage Mgmt. Learning Activities	$0.07	1,500	$98
Cover Crops Learning Activities	$0.22	450	$98
Nutrient Management Learning Activities	$0.16	1,500	$244
Total Increased Cost			**$23,822**
Annual Total Decreased Net Income			$23,8[illegible]
Total Acres in this Study Area			[illegible]00
Annual Per Acre Decreased Net Income			$16

Annual Change in Total Net Income = $82,257

Annual Change in Per Acre Net Income = $55

This table represents costs and benefits over the [illegible] area (1,500 acres) as reported by the farmer.
All values are in 2018 dollars.
Crop prices used in the analysis: Corn: $3.55/Bu, Sweet Corn: $75/Ton. Sources: Crop Values 2018 Summary, USDA, NASS (Corn), Jay Swede (Sweet Corn).
Fertilizer prices used in the analysis: Phosphate: $.39/LB, Potash: $.27/LB. Source: Estimated Costs of Crop Production in Iowa—2018
Sheet and rill erosion benefits are based on estimated nitrogen and phosphorus content of the soil and 2018 fertilizer prices. Source: NRCS Interim Final Benefit-Cost Analysis for the Environmental Quality Incentives Program, 2009.

For information about studies [illegible] strategy, see http://farmland.org/soilhealthcasestudies. For [illegible] USDA's Nutrient Tracking Tool, see https://www.cem.usda.gov/nutrient-tracking-tool-ntt. For information about USDA's COMET-Farm Tool, see http://cometfarm.nrel.colostate.edu/. This material is based on work supported by a USDA NRCS CIG grant: NR183A750008G008.
Jay has been receiving technical and financial assistance through a Conservation Stewardship Program (CSP) contract (2016 to 2020). This support allowed Jay to experiment with new cover crop mixes and new nutrient management split application techniques on a few hundred acres. The CSP income is not included in the analysis given the mismatch in years and acres between the contract and the study. Readers can assume that during the contract years, Jay received additional net income from CSP.

For more information about this study or to discuss soil health practices, please contact
Aaron Ristow, American Farmland Trust, New York Agriculture Stewardship Program Manager, aristow@farmland.org
USDA NRCS Wyoming County Office, 36 Center Street, Warsaw, NY 14569, (585) 786-3118
To read more case studies, visit farmland.org/soilhealthcasestudies

Example of Partial Budget Analysis

Economic Effects of Soil Health Practices on Gary Swede Farm, LLC (2018)

Increases in Net Income

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Annual Change in Per Acre Net Income = $55

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Jay Swede - diversified crop rotation

Genesee County

Sweet corn, alfalfa, corn silage, grain corn

Study area: 1,500 / 4,500 acres

No-till, strip-till, cover crops, & nutrient management

Cover crops: 450/ac/yr, oats, wheat, radishes or a mix in sweet corn after alfalfa, and corn silage

Annual SH Benefits: $106,079
Annual SH Costs: $23,822
Annual SH PROFITS: $82,257 or $55/ac
(2018 dollars)

343% ROI

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Increases in Net Income			
Increase in Income			
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Jay Swede Diversified Rotation

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Jay Swede Diversified Rotation

American Farmland Trust

Swede's Soil Health Practices Net Returns

Total Increased Net Income	$106,079
Total Acres in the Study Area	1,500
Per Acre Increased Net Income	$71

Annual Total Decreased Net Income	$23,822
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Annual Change in Total Net Income = $82,257

Annual Change in Per Acre Net Income = $55

Return on Investment = 345%

"In a recent wet year, the best corn was where the cover crops were"

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ENVIRONMENTAL ANALYSIS

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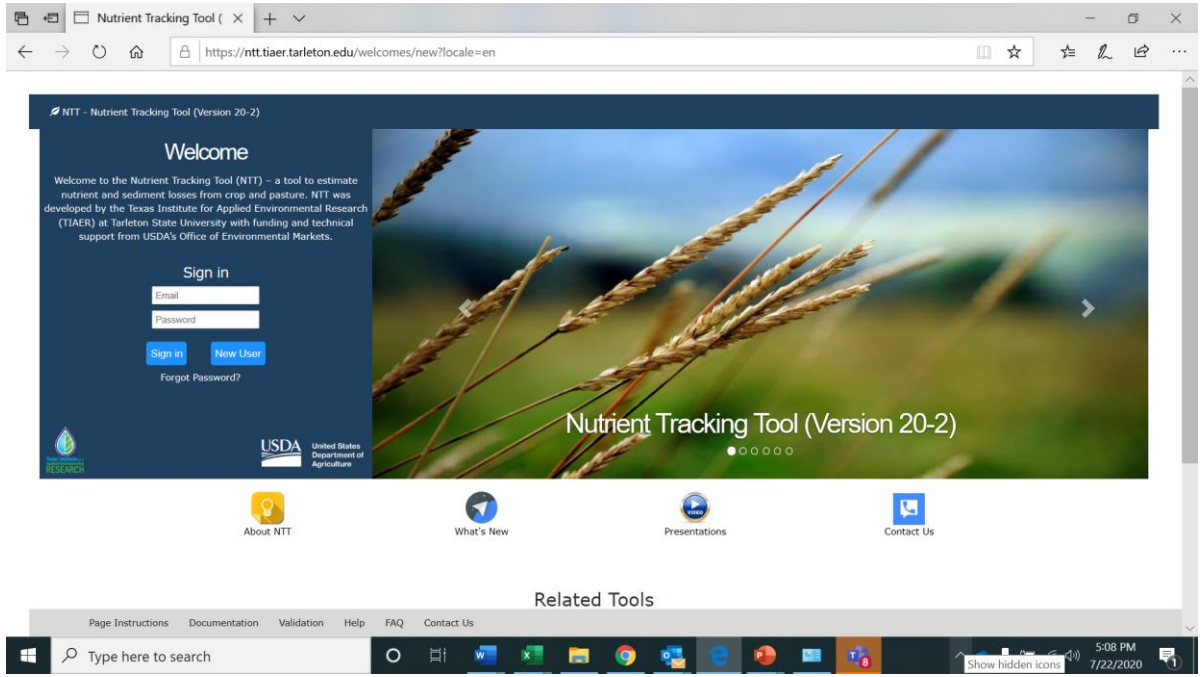
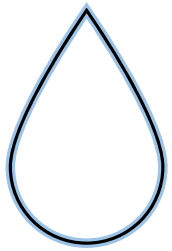
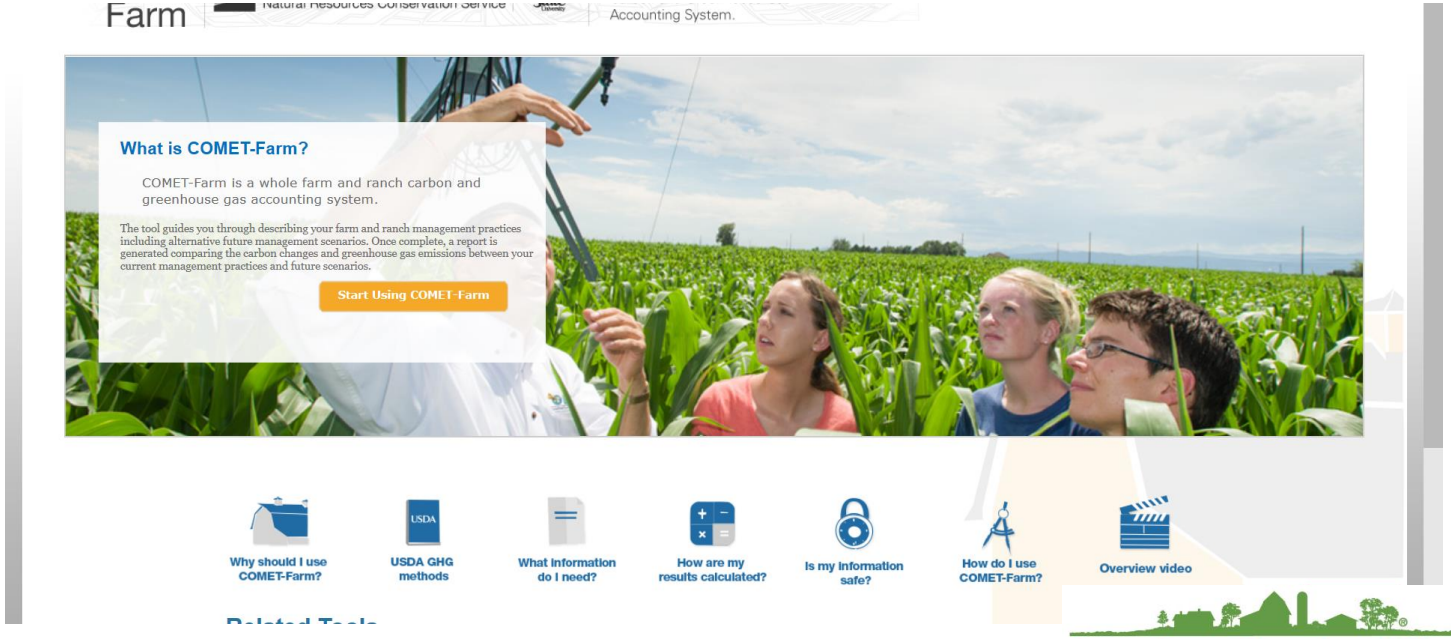


Nutrient Tracking Tool – Water Quality



COMET FARM – GHG



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Environmental Benefits of Soil Health Practices Across Six New York Farms

Water Quality Improvement (Nutrient Tracking Tool)
All 6 farms observed reduced soil and water runoff

Weighted average reduction in N losses were **32%** (range was 4 to 72)
- Weighted average reduction in P losses were **66%** (range was 33 to 92)
- Weighted average reduction in sediment losses were **81%** (range was 29 to 99)

Climate Improvement (COMET-Farm)
All 6 farms observed greater reduction of emissions

- Weighted average reduction of **312%** (range was 69 to 476)
- Average reduction of **4 cars** off the road annually

Average field size: 24 acres
Range: 10-41 acres

Soil Health Benefits

Comprehensive Assessment of Soil Health

From the Cornell Soil Health Laboratory, Department of Soil and Crop Sciences, School of Integrative Plant Science, Cornell University, Ithaca, NY 14853. http://soilhealth.cals.cornell.edu

Grower:
Jay Swede
Gary Swede Farm
104 Peoria Rd
Pavilion, NY 14525
jay@swedefarmsllc.com

Agricultural Service Provider:
Aaron Ristow
aristow@farmland.org

Forest

Measured Soil Textural Class: **silty clay loam**

Sand: **10%** - Silt: **61%** - Clay: **28%**

Group	Indicator	Value	Rating	Constraints
physical	Predicted Available Water Capacity	0.30	98	
physical	Surface Hardness	68	86	
physical	Subsurface Hardness	182	85	
physical	Aggregate Stability	68.3	96	
biological	Organic Matter	10.4	100	
biological	ACE Soil Protein Index	18.9	99	
biological	Soil Respiration	1.5	99	
biological	Active Carbon	1434	99	
chemical	Soil pH	6.7	100	
chemical	Extractable Phosphorus	5.7	100	
chemical	Extractable Potassium	170.5	100	
chemical	Minor Elements Mg: 496.4 / Fe: 1.3 / Mn: 12.7 / Zn: 1.0		100	

Overall Quality Score: **97** / Very High

Comprehensive Assessment of Soil Health

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jay@swedefarmsllc.com

Agricultural Service Provider:
Aaron Ristow
aristow@farmland.org

SWC/COG Strip-till/Cover Crop

Measured Soil Textural Class: **loam**

Sand: **27%** - Silt: **46%** - Clay: **26%**

Group	Indicator	Value	Rating	Constraints
physical	Predicted Available Water Capacity	0.24	89	
physical	Surface Hardness	46	91	
physical	Subsurface Hardness	231	73	
physical	Aggregate Stability	22.4	31	
biological	Organic Matter	4.0	87	
biological	ACE Soil Protein Index	6.5	40	
biological	Soil Respiration	0.7	65	
biological	Active Carbon	955	99	
chemical	Soil pH	6.8	100	
chemical	Extractable Phosphorus	6.3	100	
chemical	Extractable Potassium	141.6	100	
chemical	Minor Elements Mg: 313.4 / Fe: 1.8 / Mn: 12.6 / Zn: 0.8		100	

Overall Quality Score: **81** / Very High

Carbon and Climate Mitigation Benefits of Cover Crops

- **Improved soil health:** increase SOC through residue decomposition, enhance soil structure, microbial activity
- **Enhanced water infiltration and soil moisture retention:** improve water holding capacity, reducing runoff and ponding and increase resilience to drought
- **Reduced soil erosion:** protect the soil, preserving its organic matter and carbon content
- **Nutrient management:** scavenge excess nutrients, reducing nutrient leaching and minimizing GHG emissions, fix N reducing need for synthetic inputs
- **Reduced greenhouse gas emissions:** decrease nitrous oxide emissions through reduced fertilizer use and increased N fixation; capture CO_2 through photosynthesis, store carbon in biomass and root systems





PLANTING GREEN

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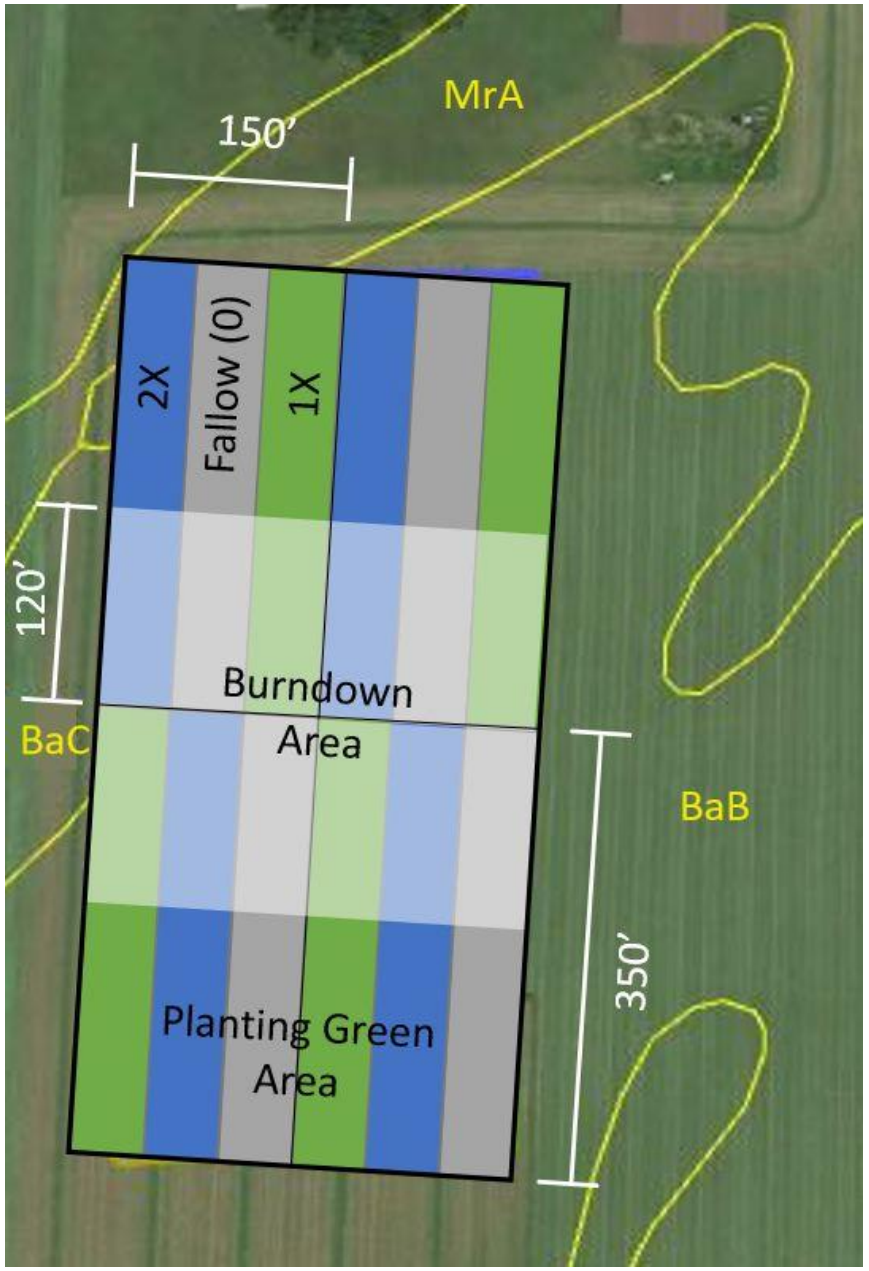
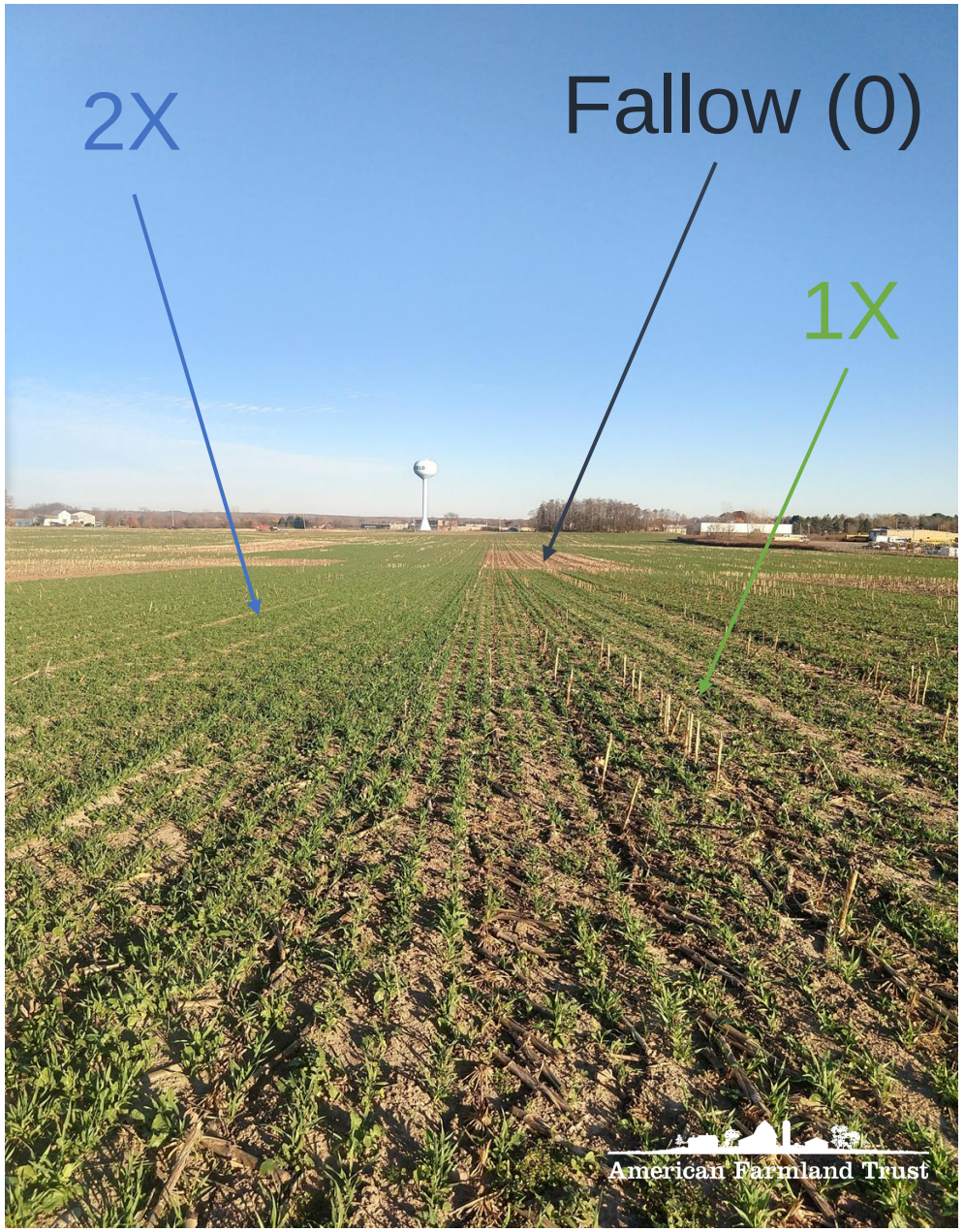
Planting Green

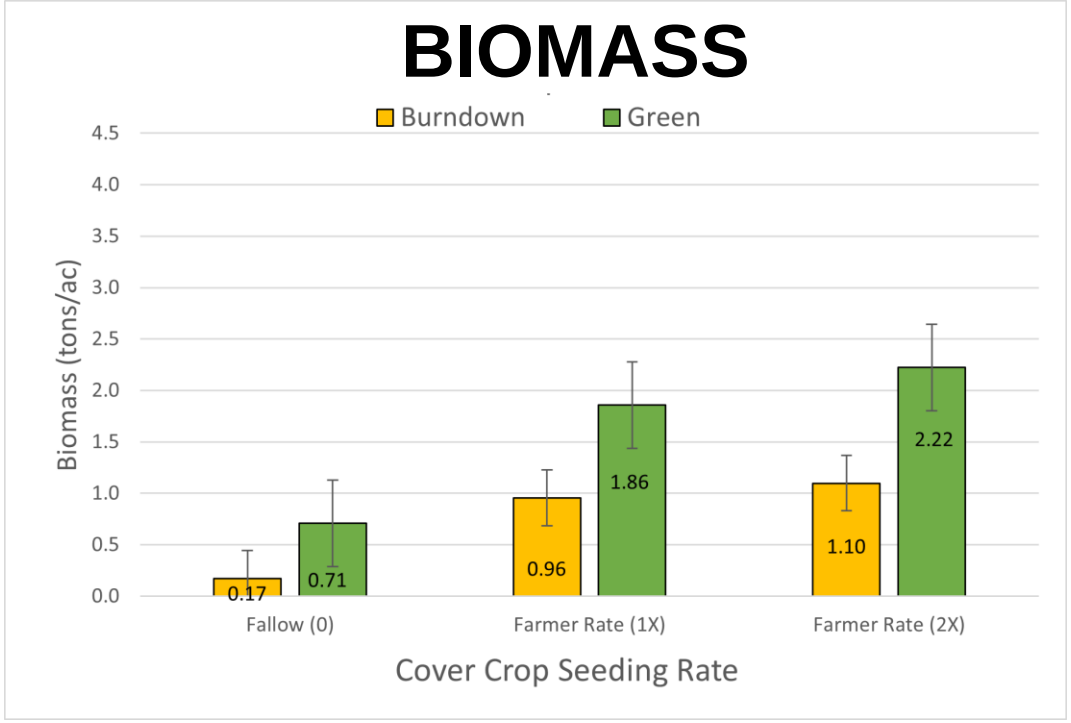
- **Planting cash crops into living cover**
- **Delay cover crop termination by a week or two**
- **Benefits**
  - Extend benefits of cover crops, while mitigating challenges of wet soil
  - Biomass accumulation, can double in two weeks
  - Dries soil at planting, conserves moisture later in growing season
- **Considerations**
  - Equipment
  - Management
  - Cool soils, delayed emergence of cash crop
  - Termination timing

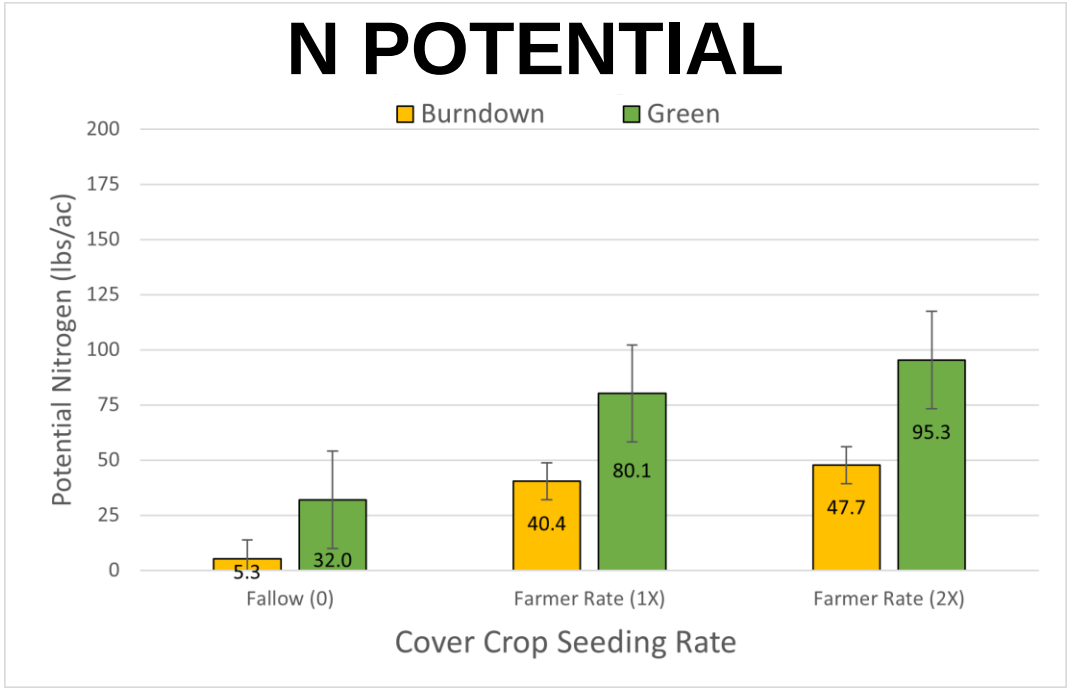
Planting Green On-farm Field Trials 2020-2023

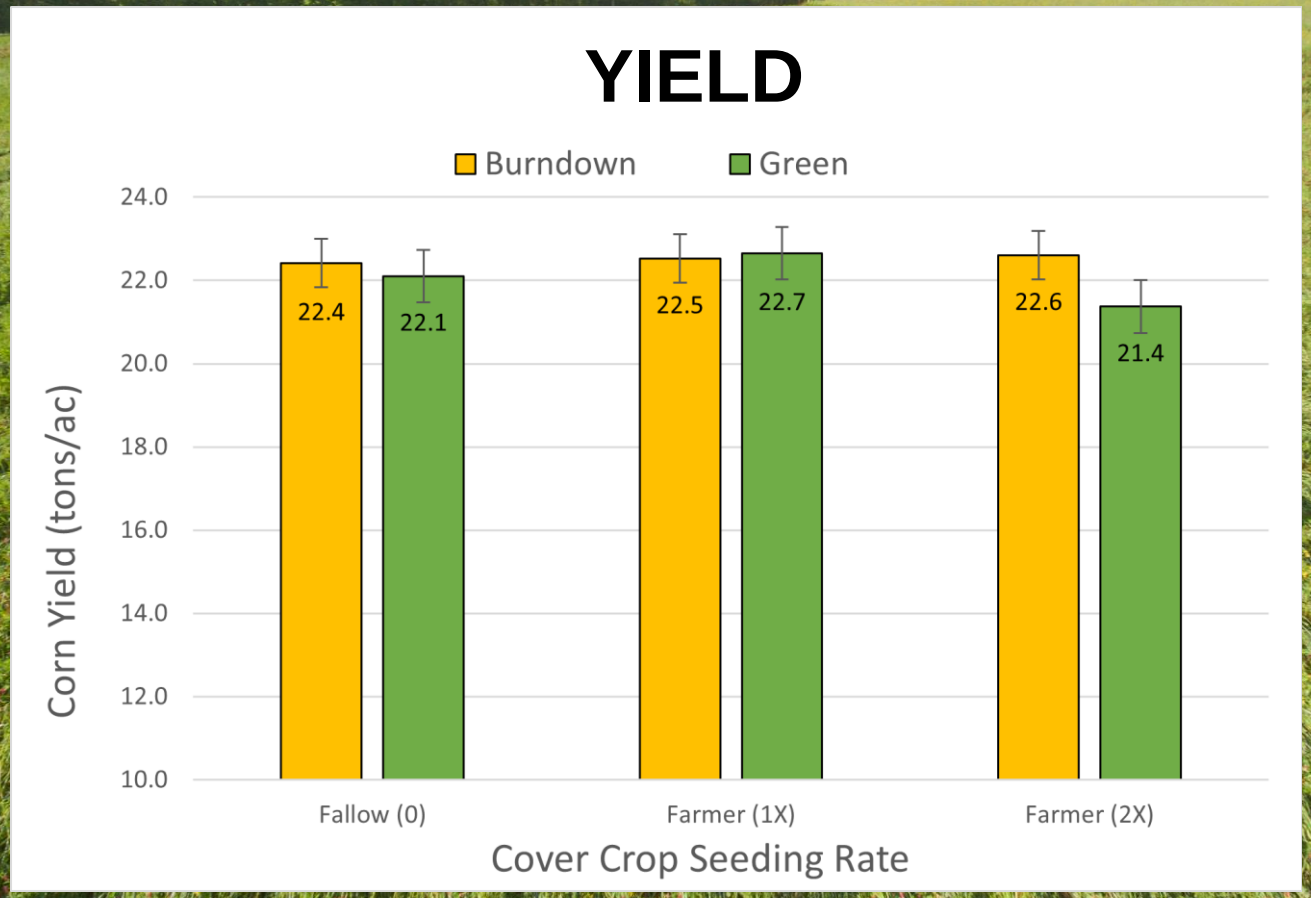




2021 Planting Green Findings

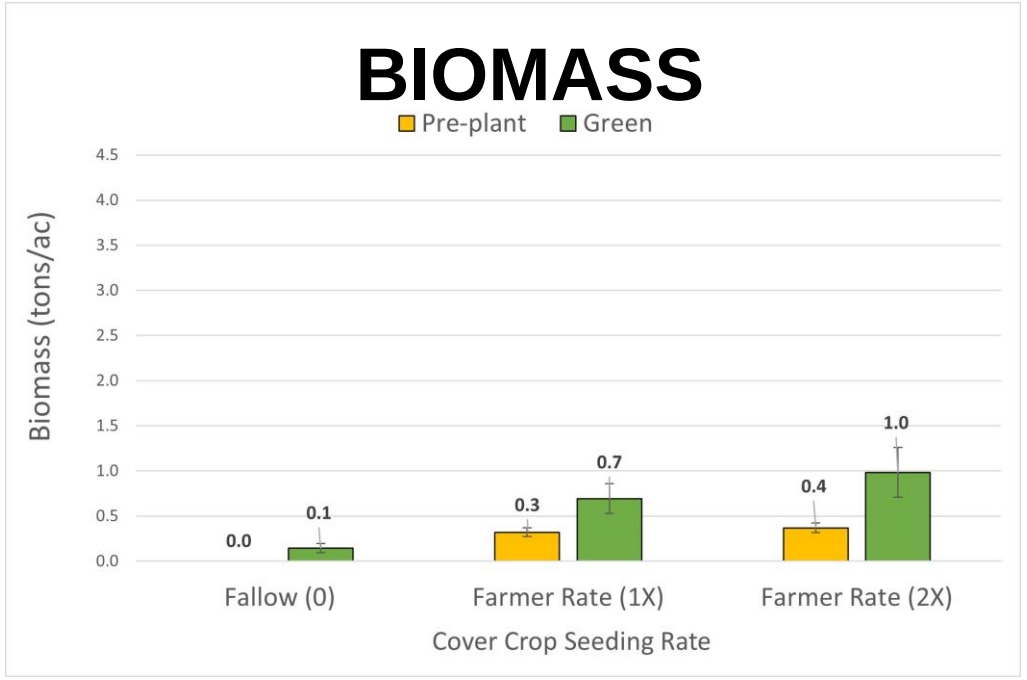


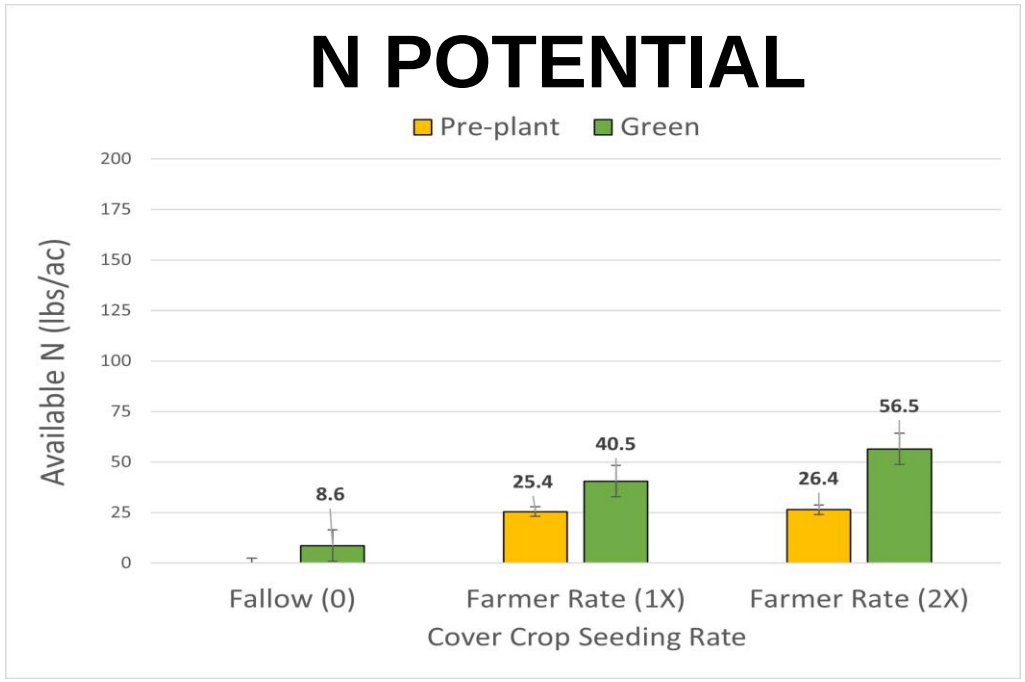




3 silage farms

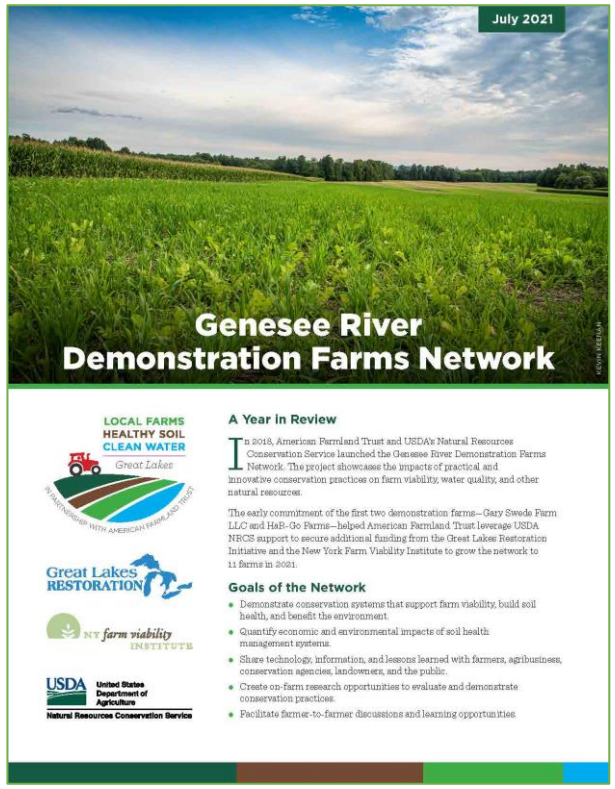
2022 Planting Green Findings





3 silage farms

Outreach, Education and Communication



- **71** presentations at local/ regional events
- **3,522** farmers, ag service providers, policy makers and researchers
- **5** Economic of Soil Health Case Studies
- **3** annual reports
- **32** AFT Facebook posts
- **34** Farmer Facebook posts
- **7** AFT Instagram posts
- **15** Videos
- **210,000** AFT email list
- **45,000** AFT Facebook
- **18,700** Twitter

https://farmland.org/project/genesee-river-demonstration-farms-network/

Aaron Ristow

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More information at: https://farmland.org/project/genesee-river-demonstration-farms-network/

Great Lakes RESTORATION

NY farm viability INSTITUTE

American Farmland Trust

USDA United States Department of Agriculture Natural Resources Conservation Service