Soil Health Case Studies: Quantifying Economic, Water Quality, & Climate Outcomes

Emily Bruner, PhD – Midwest Science Director, AFT

FEDERAL RESERVE BANK OF CHICAGO
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Outline

- Why quantify soil health outcomes?
- Project Overview
  - Team
  - Goals
  - Methods
- Project Results

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Why quantify soil health outcomes?

- Several examples of anecdotal & scientific evidence supporting the environmental & soil health benefits of conservation practices
- Less information available quantifying the on-farm economic benefits associated with improving soil health
- The agricultural community (including retailers, bankers, landlords, farmers, and others) continuously request information that considers the “bottom line”

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Why quantify soil health outcomes?

- From NRCS:

  "With soil health management, producers can increase profits and reduce costs and risk all while conserving our nation's resources for the benefit of all. …..the extent of these economic benefits has not been consistently quantified – a major constraint to soil health management adoption identified as a priority by NRCS, partners, and customers"

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Other economic case studies

- NACD & Datu (2017)
  4 farmers; 16-page each; partial budget analysis
- EDF (2018)
  2 farmers; total enterprise budgets
- NRCS NY (2017)
  2 farmers: Kemmeren & Magos; 2-pages each; PBA

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PROJECT OVERVIEW

Meet the Team

Michelle Perez
Project Leader
AFT Water Initiative Director

Florence Swartz
Project Economist
Retired NRCS NY Economist

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Meet the AFT Authors

Justin Bodell

CA Stewardship Manager

Emily Bruner

Midwest Science Director

Brian Brandt

Ag Innovations Director, OH

Aaron Ristow

NY Stewardship Mgr

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External Reviewers

- NRCS Economists
  - Bryon Kirwan, State Economist of Illinois
  - Lynn Knight, Economist, East Region
  - Lakeitha Ruffin, State Economist of Oregon
- NRCS Soil Health Specialists
  - Kabir Zahangir, West Regional Soil Health Specialist
  - James Hoorman, NE Region Soil Health Specialist
- NTT Reviewer
  - Mindy Selman, USDA OEM
- COMET-Farm Reviewer
  - Matthew Stermer, Colorado State University

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Project Goal

Drive adoption of soil health practices by:

- ✓ Quantifying the economic and environmental outcomes associated with these management changes
- ✓ Developing a persuasive education tool to convince farmers to adopt these practices on owned and rented land
- ✓ Increasing awareness
- ✓ Improving landowner and operator communication and interaction

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DESIGNING THE PROJECT

Locations selected to leverage already existing AFT work

- California: Lower Stanislaus River Watershed
- **Illinois: Vermilion Headwaters Watershed**
- Ohio: Portage and Toussaint Watershed
- New York: Genesee River Basin Watershed

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Materials developed for the Authors

- Criteria to Identify Soil Health Successful Farmers
- 4-page Handout: About the Project; Why Participate; Consent Form; Questionnaire Explanation
- List of Information to Collect Ahead of Time
- 20-page Questionnaire in Word
- 11-tab Excel Economic Calculator
- 6-tab NTT & COMET Questionnaire in Excel
- Case Study Template

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METHODS FOR ECONOMIC ANALYSIS

Partial Budget Analysis

Data Sources:

Item	Source
Labor Rate: 45-1011 First-Line Supervisors of Farming, Fishing, and Forestry Workers	Bureau of Labor Statistics - 2018 Labor Rates
Machinery Cost Estimates	Field Operations, Farm Business Mngmnt., University of Illinois, June 2017
Machinery Costs for Fertilizer Application	2018 Iowa Farm Custom Rate Survey, Iowa State University Extension and Outreach
Fertilizer Prices	Estimated Costs of Crop Production in Iowa - 2018
Index for Agricultural Costs	Producer Prices Paid Index, National Agricultural Statistics Service
Crop Prices - Non-organic, Commodity	USDA, Economics, Statistica & Market Information System, Agricultural Prices (NASS)
Crop Prices - Non-organic, Hay/Forage	Agricultural Prices, NASS, February 29, 2019
Crop Prices - Organic, Corn, Soybeans, Hay	National Organic Grain and Feedstuffs Report, National Ag. Statistics Service, December 19, 2018
Crop Prices - Organic Wheat	Baking Business November 2018 Prices
Nutrient Values	Estimated Costs of Production in Iowa, Iowa State University Extension and Outreach
Value of Nutrients in Soil (for erosion reduction benefit)	Interim Final Benefit-Cost Analysis for the Environmental Quality Incentives Program, 2009
Net Returns, Corn, Soybeans,	Commodity Costs and Returns, Economic Research Service
Production Costs, Hay	Estimated Costs of Crop Production in Iowa - 2019, Iowa State University, Extension and Outreach
National Average Hay Yield	Statistics by Subject, NASS, 2018

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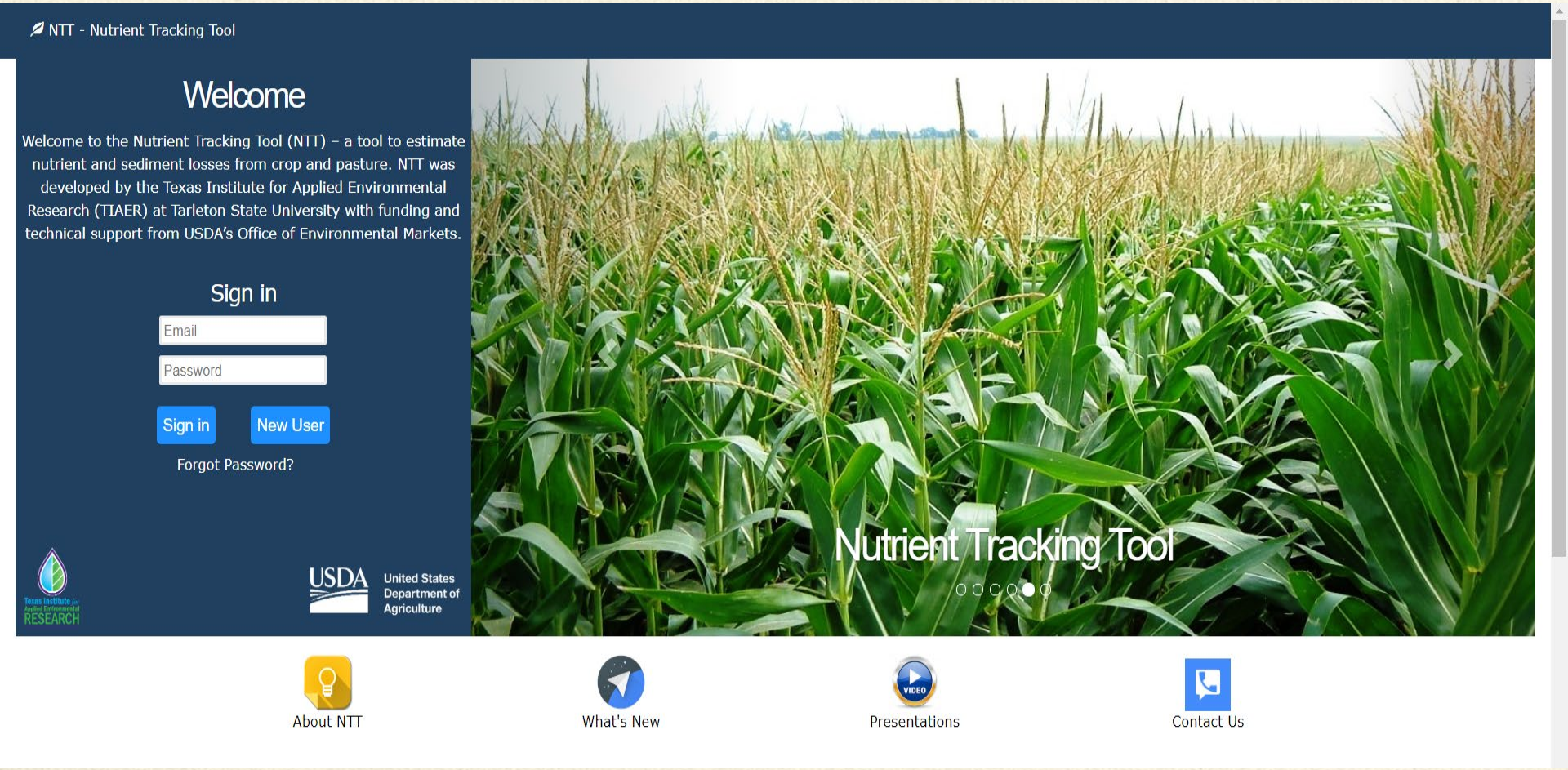
METHODS FOR ENVIRONMENTAL ANALYSIS

Nutrient Tracking Tool



http://ntt.tiaer.tarleton.edu/welcomes/new?locale=en

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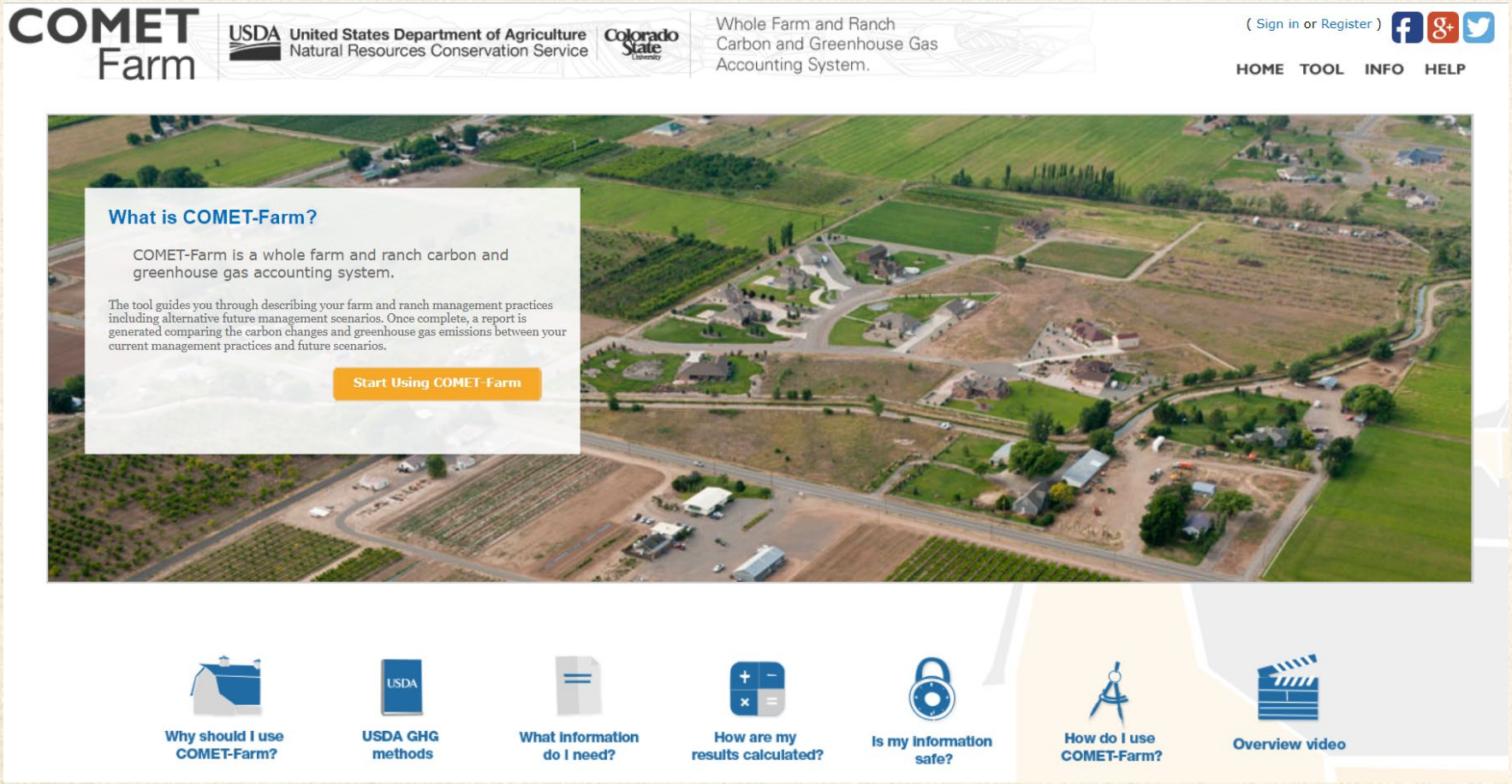
COMET FARM



http://cometfarm.nrel.colostate.edu/

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THE RESULTS

4 AFT-NRCS Soil Health Case Studies

Soil Health Case

Ralf Sauter, Okuye Farms

Introduction

Ralf Sauter and his family grow almonds on 116 acres of flat, sandy loam soil in Merced County, California. The land has been in the family for over 100 years and is protected from development by a conservation easement. Fourteen years ago, Ralf took over the operations from his mother-in-law, Jean Okuye, when he and his wife moved their family from Germany to the San Joaquin Valley.

Jean is the president of the East Merced Resource Conservation District; she pioneered the use of cover crops, compost, and micro-sprinkler irrigation at Okuye Farms, as well as owl boxes, hedgerows, and solar energy. Since taking over in 2005, Ralf has grown their farm from 80 to 116 acres and extended these efforts throughout the orchard. Ralf credits increased adoption of soil health practices to the inspiration he gained from attending grower workshops. He learned about the dual opportunity to cut cost and increase yield by implementing nutrient management, conservation cover, mulching, and compost application.

Ralf has realized multiple financial benefits from soil health, including higher yield and lower cost.

USDA United States Department of Agriculture Natural Resources Conservation Service

Seeding soybeans into cereal rye

Soil Health Case S

Larry, Adam, and Beth Thorndy

Introduction

Larry Thorndyke started growing crops over 40 years ago and currently farms with his wife, Beth, and son, Adam. The family grows corn and soybeans on 2,600 acres across several counties in North Central Illinois, leasing all but 230 acres. Roughly half the fields are flat with silty clay soils while the rest have clay and silt loam soils with 2 to 3% slopes. Faced with extremely tight margins, including rising rents and fertilizer costs, the Thorndykes wanted to reduce their inputs without hurting yield. Ten years ago, Larry began attending conferences and field days where he learned about the importance of soil biology and function, which motivated him to improve the health of his soils.

Adam Thorndyke started farming with his father in 2001, and together they started their soil health journey in 2008 by transitioning from conventional tillage to strip-till on a 200-acre bean field going into corn. Prior to this change, they would make two or more tillage passes across the field. When soil washed away, additional passes were needed to level up the field and fill in gullies.

While Larry said the transition to strip-till was painless, transitioning their soybean fields to no-till on their rented ground was a challenge. They saw some fields taking longer to transition than others due to the management by previous tenants and landowner preference. Because of this, the study only includes 1,400 acres because these acres are successfully under conservation tillage (700 acres of strip-till corn and 700 acres no-till soybeans).

USDA United States Department of Agriculture Natural Resources Conservation Service

Soil Health Case Stu

Eric Niemeyer, MadMax Farms,

Introduction

Eric Niemeyer's MadMax Farms lies in the middle of the Upper Scioto Watershed in Ohio. Eric is a first-generation farmer in his 15th farming season producing corn and soybeans. He has learned many lessons the hard way by trying different ideas and learning what practices work best on his 1,250-acre operation.

His soils are mainly silt and clay loams. Although many of his fields have flat or slightly rolling terrain, Eric saw the impact of erosion when gullies formed in low areas or where soil washed away in areas of concentrated water flow. More importantly, he recognized that using conventional tillage practices made it difficult to consistently grow a profitable crop.

Consequently, Eric spent time educating himself at workshops, field days, and conferences, and by reading about soil health practices. When Eric decided he needed to change how he farmed, he sought the help of Charlie Walker, his right-hand man and a longtime no-till innovator. Following Charlie's advice, Eric converted his cropland to no-till and adopted variable rate fertilizer application technology (VRT) in 2011. To address surface or sub-surface drainage issues, Eric repaired sub-surface drainage tile, gullies, and eroded areas. He also began taking soil tests every two years instead of every four.

In 2014, he started planting cover crops on his entire farm. Eric prefers using multi-species mixes and customizes them based on whether he is planting corn or soybeans. In addition, he fine-tunes his cover crop recipe based on what soil health outcomes he is trying to achieve. These include breaking up compaction layers, increasing

USDA United States Department of Agriculture Natural Resources Conservation Service

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,

USDA United States Department of Agriculture Natural Resources Conservation Service

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JULY 2019

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

4 AFT-NRCS Soil Health Case Studies

Ralf Sauter, Okuye Farms, CA

the cost of the micro-irrigation system
the added $60 cost per acre of switching
potassium forms from granular to liquid

Ralf allows native vegetation to grow as conservation cover over winter and mows the orchard floor in spring and summer. The cover also provides habita for beneficial insects. Since adopting thi practice, Ralf has reduced miticide spra from four times to one time every five years, saving him $30 per acre per year.

Ralf also hires a brush shredder to chop and mulch the orchard prunings. This practice replaced burning that required tractor to push prunings to the end of th orchard row where they were piled and burned costing $75 per acre. The brush shredder costs $13.50 per acre saving hi $48 per acre. Ralf believes that mulchin has led to increased soil organic matter, greater microbial activity, and improved water holding capacity.

Economic Eff

Increases in Net In			
Increase in Incom			
ITEM			
Yield Impacts due to Nutrient Management			
Yield Impacts due to Compost Application			
Total Increased Income			
Decrease In Cost			
ITEM			
Pesticide Savings due to Conservation Cover			
Savings due to Switch from Burning to Mulching			
Total Decreased Cost			
Annual Total Increased Net Income			
Total Acres in this Study Area			
Annual Per Acre Increased Net Income			

This table shows costs & benefits over the entire study are
All values are in 2018 dollars.
Crop price used in the analysis: Almond- $2.52 per lb. Av
per acre. Source: Almond Board of California.
Fertilizer prices use in the analysis: 0-0-50- $.80/LB, KTS

For more informa
Justin Bodell, American Farmland Tru
USDA NR
To read

Larry, Adam, and Beth Thorndyke, Thorndyke Farms, IL

corn yields—and ignore the yield benefits of strip-till, no-till, and nutrient management. This information is based off the last four years of data from the 2016–17 National Cover Crop Survey by CTIC.* Thus, the Thorndyke's yield bump from a consistent use of covers over the last three years led to a $16 per acre increase in net income for soybeans and $10 per acre increase for corn, or an average net income increase of about $13 per acre.

Additional benefits come in the form of lower machinery costs due to less fuel and labor needed with less tillage and using one less fertilizer pass thanks to application of P and K into the strips. This is in addition to the fertilizer savings described earlier. Fewer tillage and fertilizer passes, lower nutrient applications, and use of cover crops all translate to less sediment and nutrient loss.

In fact, USDA's Nutrient Tracking Tool (NTT) estimates that Larry reduced his N, P, and sediment losses by 45, 89, and 76%, respectively, by inst
no-till, nutrient ma
crops on a 70-acre
NTT analysis. USD
estimates that Larr
resulted in a 192%
greenhouse gas emi
field. This correspo
the road.

Achieving their soil
come without costs
hours each year or
increased cost due
addition, they spen
cover crops and ha
of herbicide for we
longer plow or culti

Partial budgeting w
analyze the benefit
adopting conservat
management, and
Thorndyke Farm.
its focus to variabl
adoption of these s

Economic Effects of Soil Health P

Increases in Net Income			
Increase in Income			
ITEM	PER ACRE	ACRES	TOTAL
Yield Impacts due to Cover Crops	$12.95	700	$9,067
Total Increased Income			**$9,067**
Decrease In Cost			
ITEM	PER ACRE	ACRES	TOTAL
Nutrient Savings Due to Nutrient Management	$66.00	700	$46,200
Reduced Machinery Cost due to Reduced Tillage	$17.68	1,400	$24,746
Reduced Machinery Cost due to Nutrient Mgt.	$2.73	1,400	$3,815
Total Decreased Cost			**$74,761**
Annual Total Increased Net Income			$83,828
Total Acres in this Study Area			1,400
Annual Per Acre Increased Net Income			$60
Annual Change in To			
Annual Change in Pe			

This table represents costs and benefits over the entire study area (1,400 acres) as reported by the farmer.
All values are in 2018 dollars.
Crop prices used in the analysis: Corn: $3.55/Bu, Soybeans: $8.60/Bu. Source: Crop Values 201
Summary, USDA, NASS
Fertilizer prices used in the analysis: Phosphate: $.39/LB, Potash: $.27/LB. Source: Estimated
Costs of Crop Production in Iowa—2018
For information about study methodology, see http://farmland.org/soilhealthcasestudies. For

For more information about this study or t
Dr. Emily Bruner, American Farmland Trust, Midwest Conse
Ford County Soil & Water Conservation District, 217-349-
Both are at: 1380 West Ottaw
To read more case studies, visit

Eric Niemeyer, MadMax Farms, OH

by planting "green" into growing cover crops, terminating them with a roller crimper. This saves him over $18 per acre. His fungicide costs have decreased as well, reducing soybean seed treatment cost by $6 per acre.

Eric believes the use of biological amendments have also contributed to his success by enhancing soil health and nutrient availability. He spends about $30 per acre for the biologicals.

Eric's no-till system has lowered labor and machinery expenses by $35 per acre. Cost savings from eliminating his tillage equipment allowed Eric to upgrade and increase the size of his planter. This led to more timely planting and helped Eric increase his farming operation from 500 acres in 2011 to 1,250 acres today.

Reduced no-till expenses are offset by increased costs for one additional fertilizer pass and cover crop planting and termination costs. Nevertheless,

the benefits of using
practices have increa
profitability of the far

To estimate the wate
benefits experienced
acre fields, USDA's N
was used and found E
cover crops, and varia
reduced his N, P, and
58, 74, and 88%, resp
field, USDA's COMET
that Eric's soil health
a 494% reduction in t
emissions which corr
17 cars off the road.

Partial budgeting anal
to estimate the benefi
adopting no-till, cover
rate fertilizer applicat
Farms. The study limi
variables affected by t
soil health practices.
a summary of these e
Eric improved his bot

Economic Effects of Soil Health P

Increases in Net Income			
Increase in Income			
ITEM	PER ACRE	ACRES	TOTAL
Yield Impact Due to Soil Health Practices	$69.00	1,250	$86,250
Total Increased Income			**$86,250**
Decrease In Cost			
ITEM	PER ACRE	ACRES	TOTAL
Nutrient Savings due to Soil Health Practices	$17.51	1,250	$21,881
Reduced Seeding Rate for Soybeans	$5.00	625	$3,125
Pesticide Savings due to Soil Health Practices	$18.75	1,250	$23,438
50% Reduction in Treated Soybean Seed	$6.00	625	$3,750
Reduced Machinery Costs Due to Reduced Tillage	$35.45	1,250	$44,317
Field Repair Savings due to Soil Health Practices	$1.00	1,250	$1,250
Total Decreased Cost			**$97,761**
Annual Total Increased Net Income			$184,011
Total Acres in this Study Area			1,250
Annual Per Acre Increased Net Income			$147
Annual Change in Tota			
Annual Change in Per			

This table represents costs and benefits over the entire study area (1,250 acres) as reported by the farmer. • All values are in 2018 dollars. • Crop prices used in the analysis: Corn: $3.55/Bu, Soybeans: $8.60/Bu. Source: Crop Values 2018 Summary, USDA, NASS. • Fertilizer prices used in the analysis: Nitrogen: $.30/LB, Phosphate: $.39/LB, Potash: $.27/LB. Source: Estimated Costs of Crop Production in Iowa—2018. • For information about study methodology, see http://farmland.org/soilhealthcasestudies. For information about USDA's Nutrient Tracking Tool, see https://www.nrcs.usda.gov/nutrient-tracking-tool-ntt. For information about USDA's COMET-

For more information about this study or to
Brian Brandt, American Farmland Trust, Agriculture Conserva
Denise Shafer, Delaware County NRCS, District Conservatio
To read more case studies, visit fa

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 16 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 health practices. The table below presents 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 higher 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
Per Acre Increased Net Income			$71

Decreases in Net Income			
Decrease in Income			
ITEM	PER ACRE	ACRES	TOTAL
None Identified			$0
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 Increased Net Income			$23,822
Total Acres in this Study Area			1,500
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 entire study 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 study methodology, see http://farmland.org/soilhealthcasestudies. For information about USDA's Nutrient Tracking Tool, see https://www.nrcs.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

Economic benefits of soil health practices outweigh the costs of implementation

Economic Effects of Soil Health Practices on Thorndyke Farms (2018)

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Yield Impacts due to Cover Crops	$12.95	700	$9,067
Total Increased Income			**$9,067**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Nutrient Savings Due to Nutrient Management	$66.00	700	$46,200
Reduced Machinery Cost due to Reduced Tillage	$17.68	1,400	$24,746
Reduced Machinery Cost due to Nutrient Mgt.	$2.73	1,400	$3,815
Total Decreased Cost			**$74,761**
Annual Total Increased Net Income			$83,828
Total Acres in this Study Area			1,400
Annual Per Acre Increased Net Income			$60

Decreases in Net Income

Decrease in Income

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

Increase in Cost

ITEM	PER ACRE	ACRES	TOTAL
Nutrient Management Learning Activities	$0.87	1,400	$1,221
Cover Crops Learning Activities	$1.74	700	$1,221
Cover Crop Costs	$39.00	700	$27,300
Increased Pesticide Cost due to Reduced Tillage	$5.00	1,400	$7,000
Total Increased Cost			**$36,742**
Annual Total Decreased Net Income			$36,742
Total Acres in this Study Area			1,400
Annual Per Acre Decreased Net Income			$26

Annual Change in Total Net Income = $47,086

Annual Change in Per Acre Net Income = $34

129% ROI

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Larry Thorndyke, IL, corn-soybeans

- Ford County, Vermilion Headwater Watershed
- **Soil health practices:** No-till & strip-till, cover crops, & nutrient management
- **Study area:** 1,400 / 2,600 acres

Annual SH Benefits: $83,828
Annual SH Costs: $36,742
Annual SH PROFITS: $47,086 or $34/ac
(2018 dollars)

129% ROI

NTT results: On a 110-acre field, N, P, & sediment reduced by 45, 89, & 76%

COMET results: Same field, total GHGs emissions reduced by 192%

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Economic benefits of soil health practices outweigh the costs of implementation

Economic Effects of Soil Health Practices on MadMax Farms (2018)

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Yield Impact Due to Soil Health Practices	$69.00	1,250	$86,250
Total Increased Income			**$86,250**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Nutrient Savings due to Soil Health Practices	$17.51	1,250	$21,881
Reduced Seeding Rate for Soybeans	$5.00	625	$3,125
Pesticide Savings due to Soil Health Practices	$18.75	1,250	$23,438
50% Reduction in Treated Soybean Seed	$6.00	625	$3,750
Reduced Machinery Costs Due to Reduced Tillage	$35.45	1,250	$44,317
Field Repair Savings due to Soil Health Practices	$1.00	1,250	$1,250
Total Decreased Cost			**$97,761**
Annual Total Increased Net Income			$184,011
Total Acres in this Study Area			1,250
Annual Per Acre Increased Net Income			$147

Decreases in Net Income

Decrease in Income

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

Increase in Cost

ITEM	PER ACRE	ACRES	TOTAL
Variable Rate Application Cost	$3.00	1,250	$3,750
Increased Soil Testing Every Two Years	$10.00	1,250	$12,500
Residue and Tillage Mgt. Learning Activities	$1.17	1,250	$1,465
Cover Crops Learning Activities	$5.86	1,250	$7,326
Nutrient Management Learning Activities	$3.32	1,250	$4,151
Using Biologicals in Furrow	$30.00	1,250	$37,500
Increased Machinery Costs due to Change in Nutrient Management	$6.30	1,250	$7,875
Cover Crop Costs	$49.50	1,250	$61,875
Total Increased Cost			**$136,442**
Annual Total Decreased Net Income			$136,442
Total Acres in this Study Area			1,250
Annual Per Acre Decreased Net Income			$109

Annual Change in Total Net Income = $47,569

Annual Change in Per Acre Net Income = $38

35% ROI

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Eric Niemeyer, OH, corn-soybeans

- Marion & Delaware Counties, Upper Scioto River Watershed
- **Soil health practices:** No-till, cover crops, & nutrient management
- **Study area:** All 1,250 acres operation

Annual SH Benefits: $184,011
Annual SH Costs: $136,442
Annual SH PROFITS: $47,569 or $38/ac
(2018 dollars)

35% ROI

NTT results: a 70-acre field N, P, & sediment reduced by 58, 74, 88%

COMET results: Same field, total GHG emissions reduced by 494%

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Economic benefits of soil health practices outweigh the costs of implementation

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			**$63,911**
Total Increased Net Income			$106,079
Total Acres in the Study Area			1,500
Per Acre Increased Net Income			$71

Decreases in Net Income

Decrease in Income

ITEM	PER ACRE	ACRES	TOTAL
None Identified			$0
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			$23,822
Total Acres in this Study Area			1,500
Annual Per Acre Decreased Net Income			$16

Annual Change in Total Net Income = $82,257

Annual Change in Per Acre Net Income = $55

343% ROI

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Jay Swede, NY, diversified crop rotation

- Genesee County Genesee River Watershed;
- Sweet corn, alfalfa, corn silage, grain corn
- **Soil health practices:** No-till, strip-till, cover crops, & nutrient management
- **Study area:** 1,500 / 4,500 acres

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

343% ROI

NTT results: On a 25-acre field, N, P, & sediment reduced by 40, 92, & 96%

COMET results: Same field, total GHGs emissions reduced by 560%

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OVERARCHING FINDINGS

Yield & Income Benefits of Soil Health Practices Across Three Farms

- **Improved Yield:**
  2 to 15% yield increases attributable to soil health practices

- **Annual Change in Per Acre Net Income:**
  Average increase for 3 row crop farmers was $42/ac/yr

- **Return on Investment:**
  Average ROI for 3 row crop farms was 169%, ranging from 35% to 343%

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Input Benefits & Costs of Soil Health Practices Across Three Farms

- **Changes to Fertilizer Costs:**

  3 row crop farmers saving $17 to $66/ac/yr

  - reduced P applications 35 to 50%
  - reduced K applications 50%

  1 farmer reduced N on corn by 5%

- **Changes to Machinery, Fuel, and Labor Costs:**

  3 row crop farmers saving $18 to $35/ac/yr, averaging $26/ac/yr

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Input Benefits & Costs of Soil Health Practices Across Three Farms

Herbicide Usage:

Mixed results:

1 farmer saves $19/ac/yr

1 farmer spends $5/ac/yr more

1 farmer was unchanged

Learning Costs:

Total cost ranged from $440 to $12,940/yr

Per acre costs range from 44 cents to $10.35

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Environmental Benefits of Soil Health Practices Across all Four Farms

- **Water Quality Improvement:**

  3 row crop farmers observed reduced soil and water runoff

  On selected fields, NTT estimated N losses were reduced 40 to 58%;

  P losses reduced 74 to 92%; & sediment losses reduced 76 to 96%

- **Climate Improvement**:

  COMET-Farm estimated total GHG emissions were reduced on each field by 192 to 560%, equivalent to taking to 17 cars off the road.

Farmer Uses of the Case Studies

We hope farmers will share the case studies with:

- **Existing landowners** - To discuss sharing the risks and rewards of the soil health investments
- **New landowners** – To add new fields
- **Bankers** –To secure additional financing for the farm expansion

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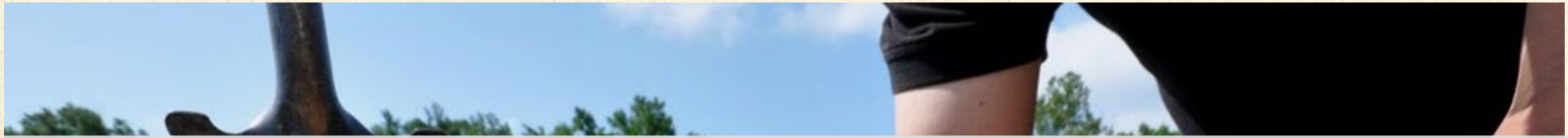

STAY TUNED!
4 MORE CASE STUDIES IN REVIEW

THANK YOU!

AFT Site:
farmland.org/soilhealthcasestudies

NRCS Site:
https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/health/?cid=nrcseprd1470394

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19 + Tasks for Authors

1. Find Soil Health Successful Famers that match the Criteria
2. Meet & discuss project with each farmer, complete the List of Things, complete signed consent form
3. Schedule interviews
4. Learn the 3 quantitative methods
5. Conduct economics interview, record it, & clean-up notes
6. Conduct NTT & COMET interview, record it, & clean-up
7. Enter economics data into the Calculator & compute results
8. Enter NTT data into NTT online & compute results
9. Enter COMET data into COMET online & compute results
10. Discus economics results with Flo & Michelle
11. Discuss NTT results with Mindy Selman, NTT lead for USDA OEM
12. Discuss COMET results with Matt Stermer, COMET lead for CSU
13. Write the case study
14. Go through review & editing by Flo & Michelle
15. Go through NRCS review

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