

Economics of Soil Health

New York Soil Health Summit



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Soil Health Management Practices

(The World according to NRCS)

- Conservation Tillage (no-till, reduced till, etc.)
- Conservation Crop Rotation
- Cover Cropping
- Field Border/Riparian Buffers
- Nutrient Management
- Integrated Pest Management

How do Economists compare?

What is the Impact on Farms? (& Society?)

Benefits*

Soil
Water
Air
Plants
Animals
Energy
“Human”

Costs*

Land
Labor
Capitol
Management
Risk

*On-farm and off-farm benefits and costs may differ. It depends on the viewpoint!.

Soil Health Practice Benefit-Cost Templates



Cover Crop (Ac) 340

Definition: Grasses, legumes, and forbs planted for seasonal vegetative cover.

Major Resource Concerns Addressed: Soil Erosion, Water Quality, Plant Productivity.

Benchmark Condition: Cropland, row crops, non-irrigated.

Date: October, 2017 **Developer/Location:** Conservation Planner, USA

Positive Effects	Negative Effects
Soil <ul style="list-style-type: none"> Reduce erosion from <u>wind and water</u> and transport of sediment. Maintain or increase soil health and organic matter content. Improve <u>soil moisture use efficiency</u>. Minimize soil compaction. Water <ul style="list-style-type: none"> Reduce water quality degradation by utilizing excessive soil nutrients. Reduce drainage, seepage and soil subsidence. Increased organic matter will buffer salts. Reduce runoff and increase infiltration. Improves infiltration, soil structure, and soil water storage. Increase soil biological activity. Reduce runoff and transport of nutrients, pesticides, pathogens and soluble salts. Air <ul style="list-style-type: none"> Ground cover helps reduce wind erosion and generation of fugitive dust. Vegetation removes CO₂ from the air and stores it in the form of carbon in the plants and soil. Plants <ul style="list-style-type: none"> Suppress excessive weed pressures and break pest cycles. Improved plant health, productivity and crop yields. 	Land <ul style="list-style-type: none"> No change in <u>landuse</u> Land utilized more intensely Capital <ul style="list-style-type: none"> Materials & planting costs. Grass/Legume Seed. Seeding Operation, No Till/Grass Drill. Herbicide, ground application. Mechanical or chemical crop kill. Labor <ul style="list-style-type: none"> Increase in labor to plant, manage, eliminate crop. Management <ul style="list-style-type: none"> Increase time managing crop production. Risk <ul style="list-style-type: none"> Other farm activities delayed while implementing the practice. In dry climates (<20 inches/year) will compete for crop moisture. May recruit unwanted wildlife. May have to convert to shorter season crops in northern latitudes.

Animals

- Increased food and cover for wildlife.
- Increased space and connectivity for wildlife.
- Supplemental forage for livestock.

Energy

- Cover crops can reduce nitrogen inputs.

Human

- Increase yields/reduce costs as land becomes more productive.
- Create sustainability of natural resources that support your business.
- Increase the property value (real estate) of your property.
- Create open space and improve habitat for wildlife.
- Conserve soil and water for periods of drought and future use.
- Prevent off-site negative impacts.
- Comply with environmental regulations.
- Save time, money and labor.
- Promote family health and safety.
- Make land more attractive and promote good stewardship.
- May be eligible for cost share.
- Increased profitability in the long run.

Net Effect: Cover crop improves soil productivity, reduces erosion at a moderate cost.

Commonly Associated Practices: Conservation Crop Rotation, Integrated Pest Management, Nutrient Management, Residue and Tillage Management, Mulch Till, Residue and Tillage Management, No Till/Strip Till/Direct Seed, Residue and Tillage Management, Ridge Till, Residue Management, Seasonal.

How do Economists compare?

Partial Budget Approach

- Small business changes have the following effects:

Positive Effects	Negative Effects
Increased Revenues	Increased Costs
Reduced Costs	Decreased Revenue

We are looking at “Before” and “After” changes only!

Example

T-Chart, Level I (descriptive), Cropland Soil Quality Improvement

<p>Name: Sandy Farmer Location: Farmville, USA Date: 2017</p>	<p>Resource Concerns/Benchmark Condition: 600 acres of cropland producing 70 bushels wheat and 50 bushels barley per acre in a two year rotation. Conventional tillage, nutrient and pest management. Resource concerns include: Sheet & Rill Soil Erosion, Organic Matter Depletion, Compaction, Surface Water Contaminants, Plant Productivity and Wildlife.</p>
<p>Conservation Treatment: Conservation Crop Rotation (Winter Wheat/Canola/Spring Barley) Residue Management (Direct Seed/No-Till) Pest Management (Annual Grasses and Aphids) Nutrient Management (Fertilizer Management)</p>	
<p style="text-align: center;"><u>Positive Effects</u></p> <p><u>Increased Revenue</u></p> <ul style="list-style-type: none"> • Wheat yield increase • Financial Assistance Payment <p><u>Reduced Costs</u></p> <ul style="list-style-type: none"> • Change in Crop Rotation • Decreased fertilizer applied • Reduce six tillage passes over the field • Reduce fuel and labor <p><u>Other</u></p> <ul style="list-style-type: none"> • Improved soil and water quality • Upland bird habitat improvement 	<p style="text-align: center;"><u>Negative Effects</u></p> <p><u>Increased Costs</u></p> <ul style="list-style-type: none"> • No-Till Drill purchase • Pest Management • Nutrient/Fertilizer Management <p><u>Reduced Revenue</u></p> <ul style="list-style-type: none"> • Possible lost aftermath grazing

Example



T-Chart, Level III (converted to “like” terms), Cropland Soil Quality Improvement

Name: Sandy Farmer
Location: Farmville, USA
Date: 2017

Resource Concerns/Benchmark Condition: 600 acres of cropland producing 70 bushels wheat and 50 bushels barley per acre in a two year rotation. Conventional tillage, nutrient and pest management. Resource concerns include: Sheet & Rill Soil Erosion, Organic Matter Depletion, Compaction, Surface Water Contaminants, Plant Productivity and Wildlife.

Conservation Treatment:

Conservation Crop Rotation (Winter Wheat/Canola/Spring Barley), Residue Management (Direct Seed/No-Till), Pest Management (Annual Grasses and Aphids), Nutrient Management (Fertilizer Management)

Positive Effects

Increased Revenue

- Change in Crop Rotation = \$25/Ac/Yr.

2 Yr Conventional Rotation	Net Returns (crop budgets)
Winter Wheat	\$100/Ac./Yr.
Spring Barley	\$50/Ac./Yr.
2 Yr Conventional Rotation	
Winter Wheat (yield increase)	\$130/Ac./Yr.
Canola	\$100/Ac./Yr.
Spring Barley (yield decrease)	\$70/Ac./Yr.

Financial Assistance Payment \$10/Ac/Yr.

Reduced Costs

- Decreased fertilizer applied 20 Lbs N/Ac (20 Lbs/Ac * \$.75/Lb / 3 Yrs. = \$5/Ac/Yr.)
- Reduce six tillage passes over the field: (\$10/Pass * 6 Passes / 3 Yrs. = \$20/Ac/Yr.)
- Reduce fuel and labor (included in the reduced tillage passes)

Increased Revenue

Other

- Improved soil and water quality
- Upland bird habitat improvement

Total Dollar Benefits = \$60/Ac/Yr.

Negative Effects

Increased Costs

- Purchase No-Till Drill purchase = \$25,000, (not included in crop budgets) (amortized at 5 Yr. Loan, 6% interest, 600 Acres) = \$9.90/Ac/Yr.
- Pest Management \$10.10/Ac/Yr.
- Nutrient/Fertilizer Management = \$2/Ac/Yr.

Reduced Revenue

- Possible lost aftermath grazing

Total Dollar Costs = \$22/Ac/Yr.

\$60/Ac/Yr. Total Benefits - \$22/Ac/Yr Total Costs= \$38/Ac/Yr. Net Benefits

Case Studies

- Give real world examples
- Usually uses Partial Budget technique
- Good case studies provide “the good, the bad and the ugly”, not just promotional.
- Relatability? Location, Climate, Crops, Available Resources
- Read with a critical eye – Are the “benefits” applicable to you? How about the “costs”?

Local Case Study Examples

➤ New York –

- Angel Rose Dairy – No-Till and Cover Cropping on 350 acres resulted in total net benefits of over \$8,000 or \$24/acre/year.

https://www.nrcs.usda.gov/wps/PA_NRCSCConsumption/download?cid=nrcseprd1298850&ext=pdf

- Dave Magos Farm – No-Till and Cover Cropping on existing 2,200 acre resulted in total net benefits of over \$78,000 or \$62/acre/year

https://www.nrcs.usda.gov/wps/PA_NRCSCConsumption/download?cid=nrcseprd1298851&ext=pdf

Things to Remember

- Adopting a conservation system is a long-term investment.
- Just like soil degradation does not happen over night, improving soil quality also takes time.
- There are agronomic benefits that result in economic benefits, such as reduced yield variability.
- In order to realize the greatest benefits from a conservation system, you have to figure out the system that works best on your operation, given your challenges and goals.