

A Farmer's Guide to Soil Health Economics

FINDINGS FROM **BUDGET ANALYSES** FOR CORN, SOYBEAN, AND SMALL GRAIN

According to the U.S. Department of Agriculture (USDA), soil science research has shown that practices which improve soil health can lead to benefits such as reduced erosion, maximized water infiltration, improved nutrient cycling, and improved resilience.¹⁰ These “soil health practices” not only have direct benefits for the producers, but they can also have public benefits for the surrounding community.

Although practices such as no-till, cover crops, change in crop rotation or nutrient management have been shown to improve soil health, adoption remains limited: just 21% of cultivated acres are in continuous no-till⁴ and only 3.9% are in rotation with cover crops.¹¹ One barrier to conservation practice adoption is that farmers bear all the costs of practice adoption while sharing the benefits with the public. Soil health practices can allow farmers to reduce input costs, and, in some cases, increase crop yield.

To shed light on the economic impacts of adopting soil health practices, we searched for relevant economic analyses. We organized the results into three factsheets highlighting key findings from surveys, budget analyses, and research trials. Here, we review **BUDGET ANALYSES**. This guide focuses on the production of corn, soybeans, and small grains.

A budget analysis is a common farm economic method to analyze potential changes that producers may experience when adopting new management systems or equipment. Two common budget analyses are partial budget analysis and enterprise budget analysis. Both methods calculate the changes to a farm budget by adding a new practice, either by comparing “before” and “after” results or by comparing the relative change between fields that have and have not adopted the practice. **Partial budget analysis (PBA)** is limited to factors that **change** due to the adoption of a new practice, whereas an **enterprise budget analysis** details **all budget items** for an enterprise whether they have changed or not.

Three organizations use similar PBA frameworks: (1) American Farmland Trust's (AFT) Soil Health Economics Case Studies¹ (2) Soil Health Institute's (SHI) 100 Farm Soil Health Factsheets³ and (3) Dr. Plastina and colleagues' journal articles at Iowa State University.^{7,8,9} AFT and SHI both interviewed row crop producers growing primarily **corn and soybeans** in various states (AFT: **NY, PA, OH, IL, OK**; SHI: **IA, IL, IN, MI, MN, NE, OH, SD, TN**) about the change in costs and benefits from adopting new practices due to new practices. AFT produced



individual case studies, whereas SHI aggregated results by state and released statewide factsheets. Plastina et al.^{7,8,9} used surveys across three articles to estimate the costs and benefits of adopting cover crops for **corn and soybean** producers primarily in three states (**IA, IL, MN**). AFT purposefully selected farmers using soil health practices with positive economic experiences. SHI selected farmers with a minimum of 5 years of soil health practice experience, implying successful implementation. Plastina et al.^{7,8,9} sampled farmers based on experience and farming management.

Both AFT and SHI highlight similar positive findings from their PBA analyses with farmers that have successfully adopted soil health practices:

- Across AFT's 10 row crop case studies and SHI's 100-farm series, AFT found an **increase in net income** after adopting cover crops ranging from **\$4/ac to \$59/ac**, and SHI found an **average income increase of \$52/ac for corn production and \$45/ac for soybean production**.
- **Yield improvements helped drive these positive results.** Eight of the 10 producers reported to AFT that they observed a yield revenue improvement of **\$14/ac to \$151/ac**. Producers in SHI's study reported average increases in yield revenue of **\$31/ac for corn production and \$29/ac for soybeans production**. SHI also notes that producers saw an **increase in yield stability**.

For a more in-depth view of one of AFT's soil health economic case studies, please see Box 1.

Plastina et al. published three journal articles using partial budget analysis and found mixed net income results for cover crop adoption.^{7,8,9} Each study used a similar survey to analyze the costs and benefits of 15,⁷ 79,⁸ and 233⁹ Midwestern row-crop farmers who have adopted cover crops by comparing their fields with cover crops to their fields without cover crops.

- Across all three studies, farmers saw negative net returns for cover crop adoption except when incentive payments or

Box 1. B&R Farms, Pennsylvania, AFT Soil Health Economic Case Study¹

B&R Farms is a multi-generational farm in Schuylkill County, Pennsylvania. AFT analyzed the adoption of soil health practices on the 360 acres allocated to a corn-soy rotation. By switching to no-till and adding a rye cover crop, the family estimated their **corn and soybean yields increased by 10%**. Adopting no-till saved **\$32/ac** in reduced machinery and labor costs. The increase in net income from no-till and cover crops outweighed their increased net costs, leading to an estimated **increase in total net income of \$20/ac**.

B&R Farms became the first farm in Schuylkill County to permanently protect their farmland under an easement supported in part by funds from the **Farm and Ranch Lands Protection Program (FRPP)**. The family said the reason they put the farm under an easement and adopted soil health practices is one and the same. The easement ensures that the land will be farmed, and the soil health practices ensure that the land can provide for the next generation.

additional grazing revenue were included.^{7,8,9} In one study, the addition of cost share (ranging from \$25 to 44/ac) led to positive net income results for soybeans after herbicide terminated cover crops as well as for corn and soybeans after winterkilled cover crops.⁸ In another study, grazing revenue led to positive results for the mean net income for the cumulative average of all crops.⁹

- In pre-survey focus groups, producers associated poor yield effects with herbicide failure or pest outbreaks. Despite the mixed net income results in the study, there was strong farmer consensus that cover crops provide soil erosion control benefits.⁷

A final set of case studies using PBA analysis comes from the National Association of Conservation Districts and DATU Research⁵ (2017), which tracked **three corn and soybean producers** from (IL, IA, MO) every year as they adopted cover crops for 3 to 5 years.

- Overall, two farms exhibited positive net income changes. Willis Farms experienced a positive return in year one thanks to yield revenue increasing by \$25/ac because the rye cover crops prevented field washouts during heavy rains. While Diaz Farm experienced two initial years of negative returns, eventually yields increased, and net income grew from -\$83/ac in the first year to \$110/ac in the fourth year.
- Though Moore Farm did not experience positive returns, they remained convinced by cover crops and expect a reduction in input and learning costs as they become more familiar with the practice.

Outside of PBA analyses, Monast et al.⁶ and Bowman et al.² used **enterprise budgets** to highlight changes that **Midwestern row crop producers** attributed to adopting soil health practices.

In summary:

- Across the three farms (OH, KS, IA), Monast et al.⁶ found net income grew after soil health practices adoption by \$9–\$47/ac for corn, \$10–\$20/ac for sorghum, and \$12–\$50/ac for soybeans. Results for wheat ranged between -\$5 and \$5/ac.
- Bowman et al.² separated seven producers (WI, IA, MO, MN, IN) into categories based on their experience with no-till and cover crops. For both corn and soybean, producers that just adopted no-till had higher net returns than conventional tillage farmers (\$377/ac vs \$324/ac for corn and \$251/ac vs \$216/ac for soybean). Producers that adopted both no-till and cover crops had the lowest net returns (\$307/ac for corn and \$173/ac for soybean).

Key Takeaways

1. Soil health practices can provide economic gains.

Producers in the AFT,¹ SHI,³ and Monast et al.⁶ reports and two producers in the NACD⁵ study experienced positive results from the use of soil health practices driven by increased yields and reductions in some input costs. However, Plastina et al.^{7,8,9} and one producer in NACD's analysis showed negative results from adopting cover crops driven by increases in cover crop costs. No-till producers in Bowman et al.² experienced positive net returns compared to conventional till producers but combining no-till with cover crops resulted in a lower net return than conventional tillage.

- ### 2. Soil health is a long-term investment.
- Farmers in both the AFT case studies and focus groups from Plastina et al.⁷ commented on the need to see soil health as a long-term investment. These comments are supported by the NACD⁵ multiyear analyses.

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