American Farmland Trust
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A Farmer's Guide to Soil Health Economics

FINDINGS FROM **RESEARCH TRIALS** 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.[23] 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-till[9] and only 3.9% are in rotation with cover crops.[25] 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 effects 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 share findings from **20 RESEARCH TRIALS**. This guide focuses on the production of corn, soybeans, and small grains.

Research trials measure the in-field impacts of different field operations. We've summarized the results from 20 studies that compare row crops with and without soil health practices and that include an analysis of changes in economic costs and benefits. The trials vary in design, but most commonly they are either: (1) **experimental plots** that an organization designed, monitored, and managed that involve at least one control and one treatment plot to analyze the new practice (14 studies);[1, 2, 4, 5, 7, 12, 13, 15, 16, 17, 19, 20, 21, 24] or (2) **on-farm demonstration trials** managed by a farmer but designed and monitored by a partnering organization involving at least a portion of a field under a new practice (6 studies).[3, 6, 8, 11, 14, 18]

Further, these trials vary in time, location, number of locations across multiple states or within a state, and number and type of treatments. Of note, 13 trials were short-term (less than 5 years). Each study tested multiple practices leading to multi-faceted results from an individual study. Below we give a broad summary of these studies. For more detailed information, please visit our website.

An earthworm surfaces amid cover crop residue after intense rainfall

USDA-NRCS

Within the trials we reviewed:

- **13 studies identified slightly higher average net income or no significant difference in net income <u>for at least one soil health treatment</u>** compared to conventional management over the short-term (6 studies)[7, 8, 11, 12, 18, 24] and long-term (7 studies).[2, 4, 5, 13, 14, 15, 16] These study results have a variety of nuances such as net income results varying with different fertilizer rates, cover crop types, and tillage depths within the trials.[2, 8, 12, 13, 14]
- **2 studies did not analyze net income but identified higher cost-effectiveness** with reduced input costs (by up to 43%), reduced soil loss, and improved drainage with the adoption of no-till and cover crops in the short-term.[17, 20]
- **1 study did not analyze net income but estimated a median cover crop (CC) cost of $40/acre** from CC management data from 112 farms in the Soil Health Partnership network (2015–2021); yield data collected in 2019 from 58 of the strip trials showed that average corn and soybean yields were lower by 0.67 bu/ac and 0.9 bu/ac (respectively); the results were not statistically significant.[6]
- **10 studies identified lower net income <u>for at least one soil health treatment</u>** compared to conventional management over the short-term (8 studies)[1, 3, 7, 8, 11, 12, 19, 21] and long-term (2 studies).[1, 14] Of the 10 research trials with lower net income for at least one treatment within a study, 7 studies found positive though lower net return compared to the control[1, 2, 7, 8, 11, 12, 19] and 5 studies identified negative net income results, meaning that the treatment was not profitable.[3, 7, 14, 19, 21] Of note, for one of the

two on-farm trials that found a negative net income result, interestingly, the negative net income improved from -$119/ac to -$48/ac between years 1 and 2, which the authors attribute to improved soil health management experience.[3]

Key Takeaways

1. **Length of time matters.** All 7 of the long-term trials (5 or more years) found a positive net income result with at least one soil health practice treatment due to either or both increased mean yield or reduced input costs.[2, 4, 5, 13, 14, 15, 16] Two of these trials also identified lower net income for other treatments compared to the control.[2,14]
2. **Location matters.** Even within a trial, location effects, including soil type/texture, weather, and crop type, have an impact on results.[1, 7, 10, 11, 12, 19, 24] For example, studies have identified no-till performs better in coarse, well-drained soils and when there is not too much or too little crop residue.[2, 5, 22]
3. **Farm size matters.** Economies of scale apply to the adoption of soil health practices. Purchasing equipment such as a no-till drill, hiring custom cover crops planting, or investing in grid sampling for advanced nutrient management is disproportionately more costly for smaller farms than larger ones.[11, 24]
4. **Experience matters.** The on-farm demonstration trials show farmers' experience with soil health practice implementation has a large impact on success.[3, 6, 8, 10, 11, 18] Badon et al. (2021)[3] directly attribute the large negative net income findings associated with reduced till and cover crops to a lack of soil health management experience.
5. **Environmental benefits matter.** It is important to consider the on-farm environmental benefits of these practices, such as reduced soil erosion, improved biological activity, and greater nutrient retention, as these benefits have the potential to reduce input costs, such as herbicide or fertilizer, in the future.[1, 4, 5, 13, 15, 18, 20] Roth et al. (2018) found 61% of cover crop costs could be recovered by incorporating the value of the benefits of soil erosion (57% of the recovered value), reduced nitrogen loading (34%), and cover crop residue nitrogen mineralization (9%).[20]

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