Investigating the Value of Soil Health Testing

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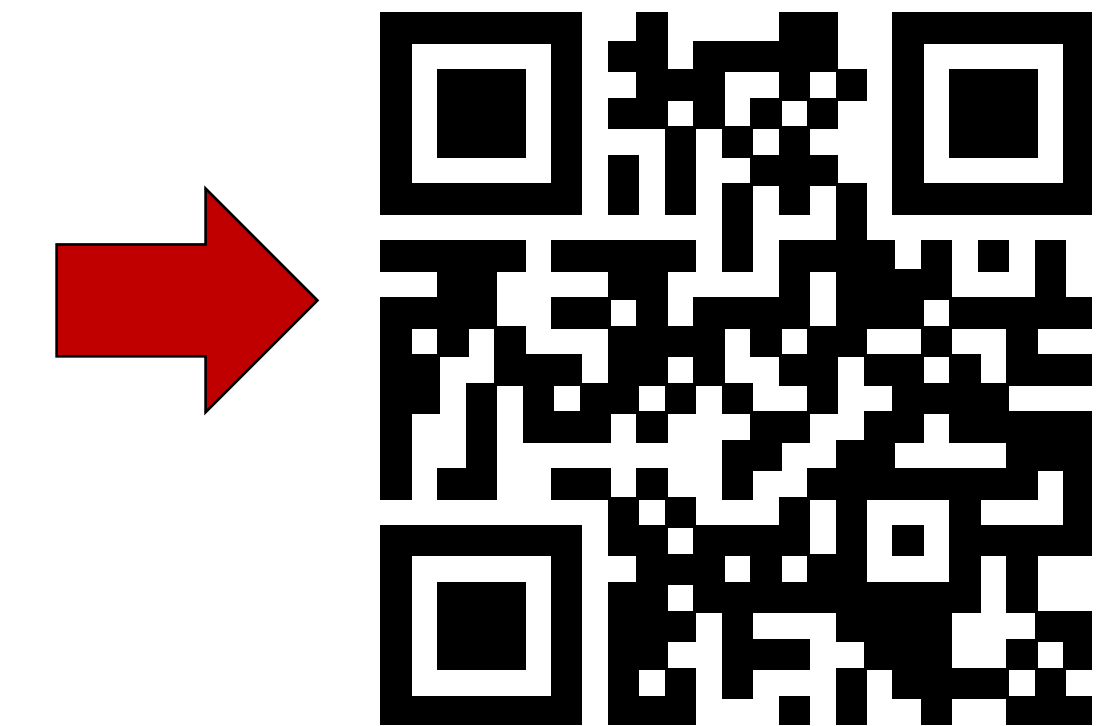
RESEARCH HYPOTHESIS

Farmers wanted help identifying ways to measure and benchmark soil health. It was important that the tests were affordable to run, reliable in providing information about changes in the soil, and repeatable and consistent to be able to monitor changes over time. Could we meet these criterion by collecting samples from fields across Ohio and compare test results with field management practices to produce guidelines for soil health testing and result interpretation?

METHODOLOGY

Samples were collected from 376 fields across Ohio from 2020-2022. A whole field sampling strategy was used to characterize the soil properties of the field (Figure 1). Cores were collected at 10-15 locations within the field and aggregated. In 2020 and 2021, cores were collected from three depths: 0-4 inch, 0-6 inch, and 0-8 inch. In 2022, only 0-8 inch cores were collected.
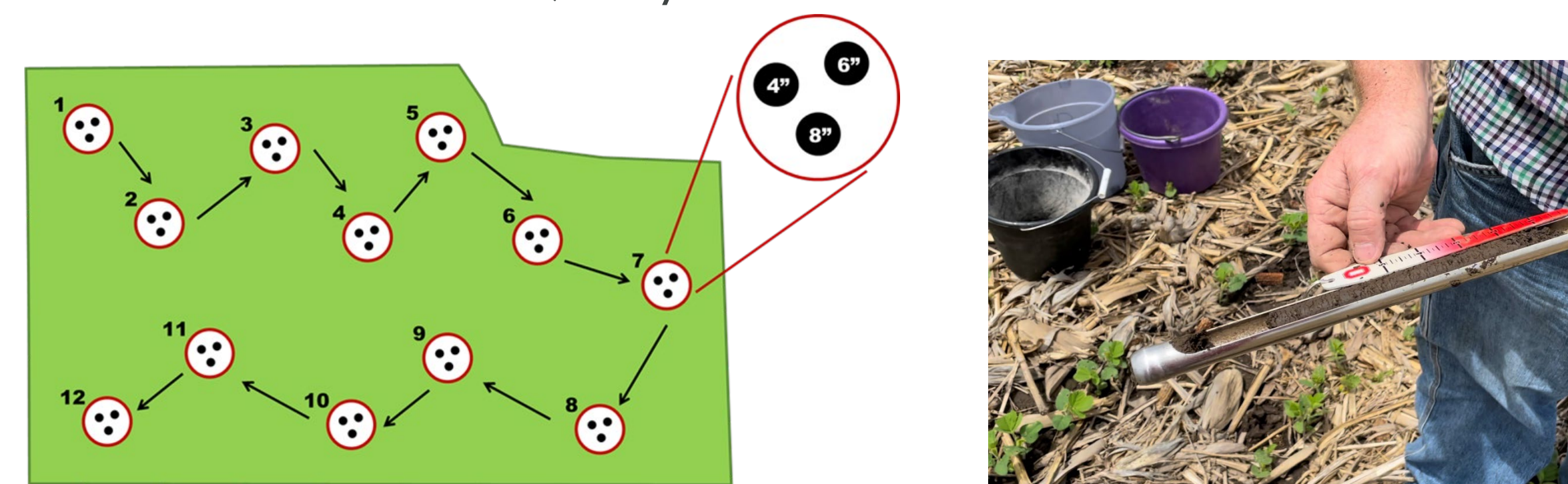

Figure 1. The whole field sampling strategy used for sampling. Cores of various depths were collected to compare results.

Samples were sent to a soil testing lab for analysis for standard soil fertility including organic matter, and emerging soil health indicators: permanganate oxidizable carbon (POxC), respiration, and wet aggregate stability (Figure 2).

Management data for the site was collected from participating farmers to document field history. To better understand the impact of conservation management on soil health, duration of no-till and cover cropping were requested.

What's measured by the main soil health tests in this project?

POxC: Readily available carbon

Aggregate Stability: Soil's shape and structure

CO_2 Respiration: Activity of soil food web

Figure 2. Soil properties estimated by the soil health indicators evaluated in this study.

RESULTS AND RECOMMENDATIONS

Depth of Sampling

There was variation in results based on sampling depth for some soil health metrics (Table 1). As sampling depth increased, soil organic matter and POxC decreased. Aggregate stability was only slightly affected with minor differences in the aggregate ratio at the 0-8 inch depth.

Since soil health values vary as sampling depth changes, it is important to keep depth consistent over time so the results can be compared . Generally, 0-8 inch cores are recommended because they line up with the recommendation for Tri-State Fertility sampling. This makes it convenient to include soil health analysis during routine fertility sampling.

Table 1. Sample results by depth of cores.

Depth	Soil pH	Organic Matter (%)	POxC (mg/kg)	Macro-aggregates (%)	Micro-aggregates (%)
0-4"	6.4	2.7	678	79	21
0-6"	6.4	2.5	621	79	21
0-8"	6.4	2.4	583	77	23

Soil Type

Soil type had an influence on all soil health metrics and is important to consider when comparing soil health between fields and even zones within fields. As CEC increases so do the values for organic matter, POxC, and aggregate stability. Because of this relationship, the soil health values for a field will be dependent on the soil type starting out. This is one of the main reasons making comparisons within fields is recommended instead of trying to compare fields to each other.

Management History

The soil health indicators tested were able to detect changes in soil properties over time across differing management practices. Figure 3 shows the relationship between POxC and the continuous no-till and cover crops. As years in no-till increase, the POxC value decreases slightly. However, when cover crops are introduced, we see an increase in POxC values. Figure 4 shows the influence of no-till and cover crops on respiration. Increased duration of no-till results in a decline in respiration values while years in continuous cover crops show a slight increase.

Summary

The soil health indicators tested showed the ability to detect differences based on management over time and have the potential to be used to track changes in soil health at the field level. Sampling depth and soil type are important considerations when making comparisons and benchmarking soil health. Through this work, Ohio farmers were provided with recommendations for selecting soil health tests and results to help them understand what the results mean (go.osu.edu/sh-baseline).
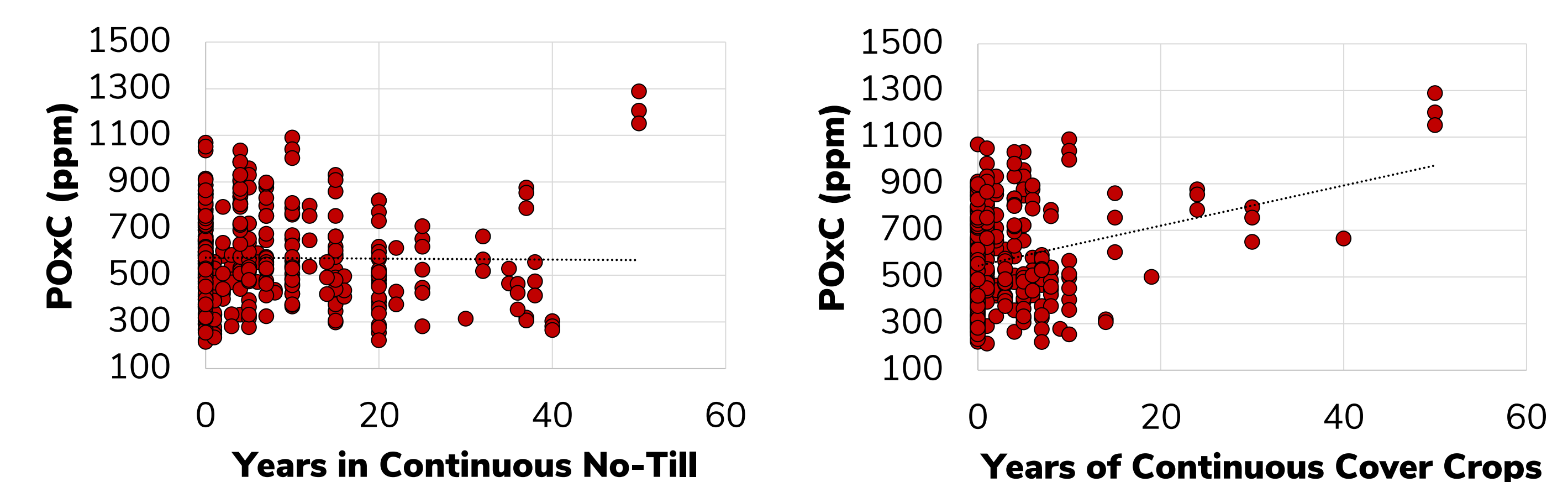

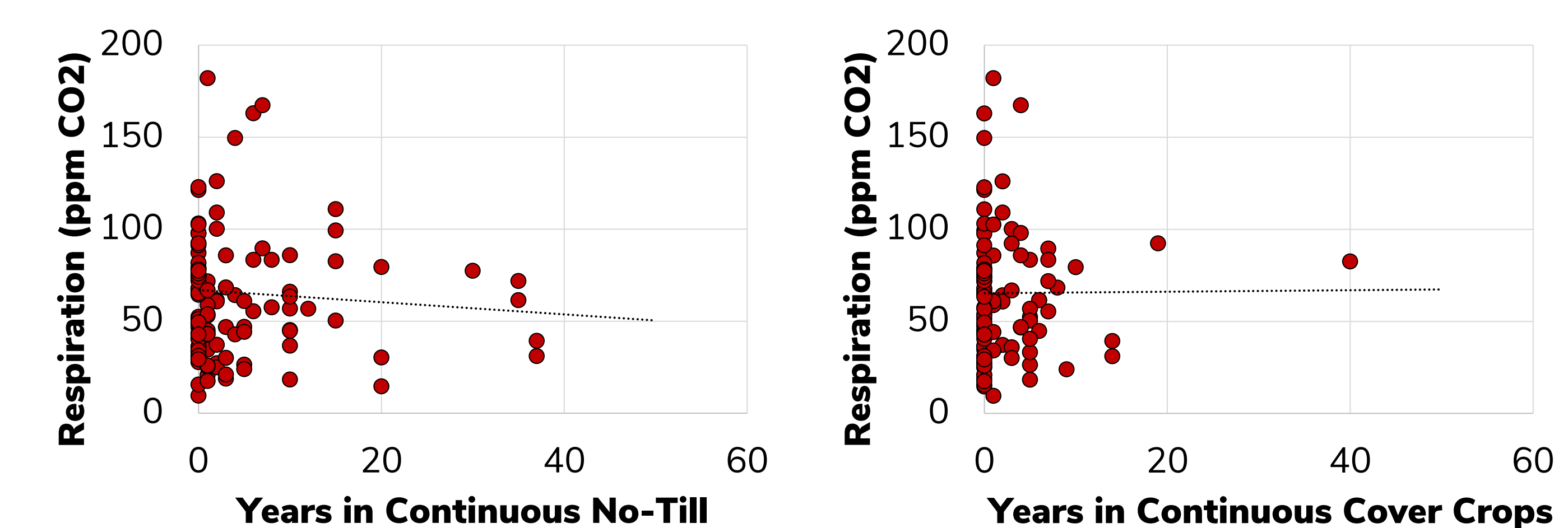Figure 3. Changes in POxC values (ppm) under continuous no-till and cover crops.

Figure 4. Changes in respiration values (ppm) under continuous no-till and cover crops.

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