ORGANIC FARMING RESEARCH FOUNDATION

# FARMER-LED TRIALS REPORT

## COLBY FARMS

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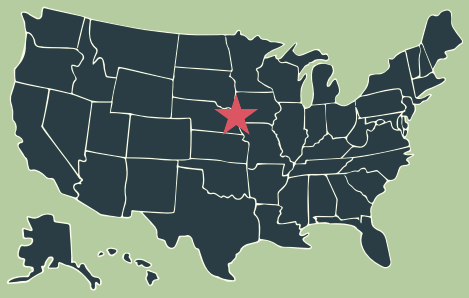
# Farmer-Led Trials: Cover Crops for Soil Compaction



2024

Farmer-Researchers:
Becky and Tim Colby
Colby Farms
Papillion, NE

## IN A NUTSHELL

This trial investigated the effectiveness of various cover crops in reducing soil compaction while providing weed suppression and pest resistance. The treatments included rye, canola (rapeseed), Groundbreaker Daikon radish, and Jackhammer Radish, with mowed peas followed by an oat/vetch mixture as the control. Soil compaction was measured using a penetrometer, while weed counts were taken observationally. While there were no statistically significant differences detected in the soil penetration depth between treatments, the Colby's observed soil structure improvements in the Daikon radish treatment. The penetrometer may lack sensitivity to capture observed field improvements, and future trials may benefit from alternative measurement methods.

*Becky and Tim Colby on their farm.*

## ABOUT THE FARM

Colby Farms, located in Papillion, Nebraska, is a 30-acre farm, of which 14 acres are cultivated and about 5 acres are currently in use. Owned and operated by Becky and Tim, the farm is in its third year of transitioning to organic practices, with a history of conventional soybean and corn farming, along with some dairy cows and horses.

Becky and Tim moved back to the family property in Nebraska after running a farm in Arizona for three years. The farm is actively engaged in improving soil health through cover cropping, with big plans to include a vegetable garden and fruit orchard. They are excited to expand on their on-farm conservation work and serve their community with farm to school programs, value-added food classes, and a commercial kitchen.

*Tim Colby, terminating a cover crop.*

***Research Question:***

*Which cover crop will be best for reducing soil compaction? The Colby's tested five different cover crop varieties:*

- *Mowed Peas, oat and vetch: Control*
- *Rye*
- *Canola (rapeseed)*
- *Groundbreaker Daikon radish*
- *Jackhammer Radish*

## WHAT WAS THE ON FARM TRIAL ABOUT?

The Colby's wanted to conduct a farm trial to assess the effectiveness of various cover crops in reducing soil compaction.

The Colby's hypothesis was that certain cover crops, especially the daikon radish varieties, would outperform others in reducing soil compaction. An additional goal was to be able to record observations on the potential for different cover crops to help suppress weeds and insect pests.

Becky and Tim's farm is in its third year of transitioning the land from conventional to organic practices, and they are actively working to improve soil health. Soil compaction is a known issue, and traditional tillage methods for addressing it are not aligned with the sustainable and effective biological solutions that they want for their land. By conducting this trial, they hope to have informed cover crop choices for the future, allowing them to select species best suited for their specific soil conditions and that enhance the physical structure of their soil, leading to better water infiltration, root growth, and overall soil ecosystem health.

## HOW WAS THE TRIAL DONE?

The trial utilized a Randomized Control Block Design with five treatments:

- Control: Mowed peas, oats, and vetch
- Rye
- Canola (rapeseed)
- Groundbreaker Daikon radish
- Jackhammer Radish

The Colby Farms trial utilized approximately 2 acres, with each replicate block measuring 100' x 40'. Rows were spaced 6' apart and were 3' wide.

Soil compaction was measured using an AgraTronix 08180 Soil Compaction Tester (penetrometer), which assesses soil penetration resistance. Initial penetrometer readings were recorded on July 23, 2024, prior to cover crop planting.

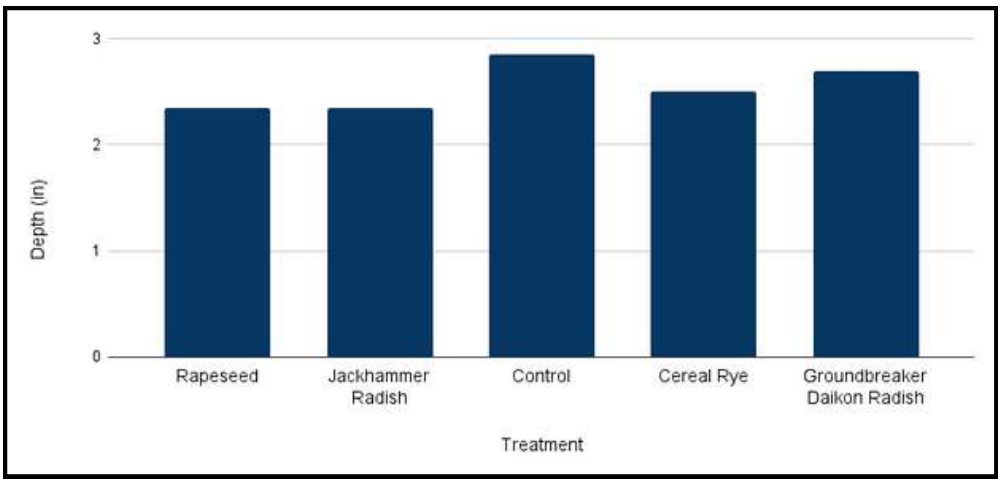



*Figure 1. Increase in soil penetration depth in spring 2025 vs fall 2024, across different cover crop treatments. No significant statistical differences were observed (α=0.05).*

Following the winter-kill of all cover crops, Becky and Tim took subsequent measurements on April 3, 2025. Ten penetrometer readings were taken in a zig-zag pattern down the center of each 100-foot row.

The Colby's found that the penetrometer predominantly measured penetration resistance at two pressures, 200PSI and 300PSI. In order to make inferences about pressure changes, they recorded the depth at which the pressure required for soil penetration increased from 200PSI to 300PSI. Using the fall and spring data points, the difference in depth of penetration at 200PSI was calculated, and data was analysed using ANOVA, with treatment as the factor.

## FINDINGS

Across all treatments, soil penetration at 200PSI increased by 2.55 inches from fall to spring ($p<0.001$). However, no differences were detected between treatments (Figure 1). Since Becky and Tim do not leave any of their soil uncovered, there was no non-cropped control treatment included in the study. We hypothesize that the increased soil penetration in the spring vs the fall may have been due to the presence of a cover crop, regardless of what cover crop was planted.

*Cover crop trials at Colby Farms.*

*"We learned a lot by doing this trial. This land is still pretty new to me. So, it put me out walking the rows a lot more often and becoming more familiar with the soil and seeing how it's changed. It's noticeable, the change. It's noticeable to anybody. So, that is a tangible takeaway."*

*- Tim Colby, farmer-researcher*

## FARMER OBSERVATIONS

- Heavy spring precipitation and standing water in some areas of the field contributed to poor plant growth, crop die-back, and increased variation in the experiment.
- Penetrometer readings were difficult to get in the daikon radish plots as the radishes created large, deep pores where the penetrometer would easily sink.
- Both Groundbreaker and Jackhammer radish had overall excellent penetration and weed suppression. However, the Groundbreaker radish grew thicker tubers than the Jackhammer Radish and was the preferred variety of the two.
- Rye remained green through winter, requiring spring termination to stop aggressive growth, but rye was effective at suppressing weeds.
- Rapeseed performed poorly overall compared to other cover crops, in terms of both weed suppression and crop growth.

*Testing soil compaction with a pentrometer.*

## TAKE HOME MESSAGES

No statistically significant differences in soil penetration depth between treatments was observed, and this may indicate that having the soil covered with a crop is more important than the actual cover crop selected. That said, the soil penetrometer may lack sensitivity to capture observed field improvements, and we hypothesize that future trials may benefit from alternative measurement methods (e.g., bulk density).

While the data did not reflect differences in soil penetrability among cover crop treatments, the Colbys observed soil structure improvements. Notably, daikon radish and rye treatments were the most weed suppressive, and both daikon radish varieties contributed to greater visual improvements to the soil structure and penetrability.

Another added benefit of conducting the trial was that Tim became much more familiar with the land through frequent field walks, and he made different choices for subsequent crop placement based on his new knowledge.

## ACKNOWLEDGEMENTS

This report is made possible by OFRF's Farmer-Led Trials program. In this program, farmers receive technical support to address their challenges through structured on-farm trials. To learn more about OFRF Farmer-Led Trials Program, visit our website page at https://ofrf.org/research/farmer-led-research-trials/

To cite this paper, please use the following: Tim and Becky Colby, M. Hathaway, H. Estrada, T. Velez. 2024. Farmer-Led Trials: Cover Crops for Soil Compaction. Final Report. Organic Farming Research Foundation. www.OFRF.org

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# Farmer Led Trials Program Spotlight: Colby Farms

*Written by Jose Perez, OFRF's Research & Education Engagement Coordinator*

Tim and Becky Colby own Colby Farms, a 14 acre farm in Papillion, Nebraska, where they produce vegetables, fruits and some livestock products for their community. As beginner and veteran farmers, they are in their second year of transitioning a historically conventional farm to organic production. Having previously farmed in Arizona for 3 years, they came back to Nebraska to tend the land where Becky's grandfather once farmed.

Tim and Becky have exciting plans for their farm. They hope, in time, to create a farm-to-school program, offer value-added food classes, and build a commercial kitchen. They hope to establish a fruit orchard with apples, peaches and other stone fruits to offer u-pick, as well as raise chickens, goats, bees, and perhaps cows.

**Dealing with soil compaction**

The farm is located in a floodplain with clay heavy soil vulnerable to compaction. Decades of conventional corn and soybean rotations have contributed to this problem. Tim and Becky knew from the beginning that they needed to improve soil structure to produce quality crops. A USDA representative also noticed soil compaction and recommended using deep taproot cover crops to address this challenge.

In their first year at their Nebraska farm, they planted a sorghum sudangrass cover crop, which resulted in a lot of organic matter produced. However, they quickly noticed that the cover crop roots had failed to penetrate the soil beyond the hardpan.

Tim and Becky had a lot of questions to address regarding the use of cover crops to reduce soil compaction: What cover crop species should they use? How many cover crop cycles are needed? And, would there be any potential weed or pest concerns? Weed pressure is very high due to continuous use of the same crop rotation in the land for over 30 years. Sorghum sudan appeared to provide very good weed suppression but only after mowing three times. On the other hand, they are concerned about possible infestations of Japanese beetles, which have occurred in the past on soybeans. How would the cover crop respond to such an infestation? This is where their interest in OFRF's Farmer Led Trials (FLT) Program came in.

Q: What motivated you to apply for the FLT program?

*"Being part of the FLT program was a no-brainer for us on our farm. The land on our farm is in desperate need of rejuvenation and planting cover crops is the obvious solution. By partnering with OFRF, not only do we get some funding but we get to create a project that will help us determine the very best cover crops to solve some of our soil health issues. We get expert advice and feedback through all stages of the project from planning, implementing, data collection, and interpreting results. Then, at the end, not only does our Farm get answers to legitimate questions that will improve our soil, but we get to share this data with others that might be asking the same question. FLT's are a win-win-win scenario for the farmer, the research group, and future farmers that will be able to learn from the data."* – **Tim Colby**

**Farm trial plan**

OFRF staff is currently working with Tim and Becky to figure out the best way to establish a cover crop comparison trial that can point towards the best cover crop options for reducing soil compaction at the farm. Using a 2 acre area, preliminary plans are to plant a mix of peas, oats and vetch during spring and make the comparison for the fall season using daikon radish, tillage radish, rye and canola cover crops. Preliminary measures include soil compaction, weed suppression, and soil nutrient levels through lab analysis.

Tim and Becky know that dealing with soil compaction goes beyond just planting deep-rooted cover crops. They have plans to use reduced tillage practices, and create permanent beds and living walkways in order to minimize soil compaction. All these measures will contribute to a healthier soil structure. At OFRF, we are excited to be a part of the Colby's learning journey, and hope that their work will inspire more farmers to conduct research trials on their farms.

# Contact Us


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Learn more about OFRF's
Farmer-Led Trials Program

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