EFAO
ECOLOGICAL FARMERS ASSOCIATION OF ONTARIO

2025

Using leaf mulch for preparation of new ground

FARMER-RESEARCHER
Alberto Suárez-Esteban,
Nature's Apprentice Farm

IN A NUTSHELL

Alberto's trial measured total carbon, compaction and weed cover in order to determine whether the method was effective at suppressing weeds and benefiting soil health. He demonstrated that thick leaf mulch is a viable way of preparing future growing spaces.

- Soil compaction did not change over time or between treatments, which was potentially also negatively impacted by drought conditions in 2025
- Both one and two layers of leaves with bags successfully reduced weed cover
- Total carbon increased by a small, but statistically significant amount over time

MOTIVATION

Preparing new ground for agricultural production without disturbing the soil or using chemicals represents a significant challenge for ecological farmers. The common solutions to suppress weeds and spread compost to restore fertility can be very time consuming, costly and labour intensive. Alberto observed previously that leaf piles left in place created clean beds and appeared to contribute to soil health. His farm is also small and has no tillage equipment available. He did, however, have a connection to an abundant source of leaf bags. It was imperative to find a method that matched his farm's needs. He decided to test if thick layers of leaves could smother weeds and create the right, fungal dominated soil conditions for a future food forest in an existing hay field on his farm.

Alberto in the field

METHODS

Alberto compared two leaf mulch treatment variations:

1. One layer treatment: a 30 cm (12") uniform layer of deciduous tree leaves on top of an underlay of used, flattened yard waste bags
2. Two layer treatment: same as previous but with the additional layer of bags on top (forming two layers)

Alberto chose not to implement a control since, in the absence of a treatment, the area would remain with 100% weed cover by rhizomatous grasses like reed canary grass and smooth brome. Instead, Alberto took baseline soil measurements, which he used as a comparison instead of a control.

The field Alberto selected for his trial was approximately a half acre. Each treatment had five plots measuring 5' x 4' for a total of 10 plots. See **Figure 1** for the field layout. Rectangles with a blue outline represent blocks (five total), to capture variations in parent soil, which was sandier to the southwest. The orange circles represent plots (one of each treatment in each block). The exact location of the plots within the blocks varied. The rest of the field was mowed and allowed to grow how it did previously.

Alberto applied the initial field layout and treatment application in the fall 2023 and monitored and measured the site again in fall 2024 and 2025. The plots were not planted into and leaves were not reapplied.

MEASUREMENTS

Alberto used three different tests to measure changes in soil conditions over time with the two treatments: total carbon, compaction and weed suppression.

For total organic carbon (C), which Alberto measured in 2023 and 2025, he took composite samples from the replicate plots of each treatment.

Figure 1. Field layout
Blue rectangles: Treatment blocks
Orange circles: Plots, 1 of each treatment in each block

To measure compaction, Alberto used a penetrometer, taking a baseline measurement in 2023 followed by two more measurements in 2024 and 2025. Penetrometers measure subsurface compaction, mimicking a root's ability to penetrate the soil. The measurement taken is how deep the penetrometer can be inserted before it hits a defined resistance (for Alberto's trial, 200 and 300 psi). At 300 psi, roots are no longer able to penetrate the soil.

Lastly, to measure weed suppression, Alberto took photos before applying the treatments and each year subsequently, measuring the percent weed cover present. He divided each plot into six smaller squares and estimated the percent cover in each square for a total percentage of each plot. The dominant weeds in the trial area were pasture grasses and included reed canary grass.

DATA ANALYSIS

To evaluate the effect of the treatments on soil compaction, total carbon, and weed cover, we employed the statistical program R and used a general linear model with a normal distribution and block and year as random factors to assess soil compaction at 200mm and 300mm depths and total carbon; and a general linear model with a quasibinomial distribution and block and year as random factors to assess weed cover, measured as the proportion of weed cover relative to total plot area. We also ran paired t-tests to compare total carbon and compaction values within the same plots between 2023 and 2025. We could make these statistical calculations because the experimental design involved replication of the treatments across blocks and years.

FINDINGS

TOTAL CARBON

- There was no detectable difference in total C between one and two layers of leaves (P = 0.49).
- Over two years with leaves as mulch, total C increased on average 0.28% irrespective of treatment ($P < 0.003$). Total carbon often takes time to show a measurable difference. Although the change was small, the amount was statistically significant.

COMPACTION

- There was no detectable difference in compaction between treatments or over time at either 200 (P = 0.76) or 300 (P=0.86) psi.
- Originally, between 2023 and 2024, the compaction numbers had improved, but in 2025 they appeared to worsen again. It is uncertain why this occurred, but the drought in 2025 could be a contributing factor. Penetrometer readings are not very precise and, at the same time, need a certain amount of soil moisture for accurate readings. Alberto also reported that in 2024 there was a high level of earthworm activity, but in 2025, during the drought, earthworm activity dropped dramatically. This not only potentially points to soil moisture levels being low, but also could have impacted the lack of integration of the organic material in soil.

% WEED COVER

- Two layers of leaves and bags were more effective at controlling weeds than one layer in both 2024 and 2025 (P = 0.02). By 2025, the one layer treatment had a mean of 60% weed cover, compared with 31% for the two layer system. The majority of the weeds present in 2025 returned through rhizomes versus seed from nearby grasses.

NEXT STEPS

Alberto continues to add fruit trees to his farm each year and has integrated the mulching process into his planting procedure. He has also added manual weed removal, as much as possible, as the first step before mulching and then planting. He noted anecdotally that trees grew more favourably when planted in the leaf mulch as compared to trees planted without, despite being planted

Single layer treatment

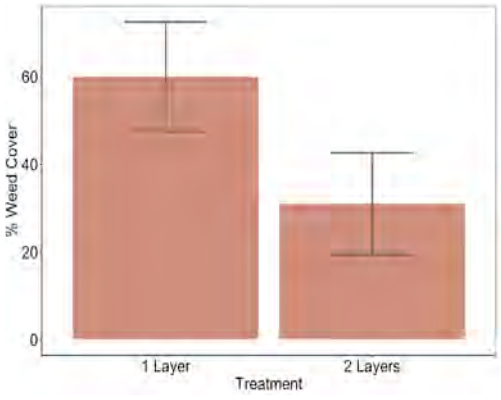

Figure 2. Percent weed cover in 2025

at the same time and of the same height. Likely, he posits, this was due to a combination of the carbon-rich mulch's ability to encourage the growth of beneficial fungal communities, the retention of moisture and the smothering of weeds.

TAKE HOME MESSAGE

After conducting his trial, Alberto will continue to use leaves with bags as a way to prepare new ground. His trial demonstrated to him leaf mulch is a good solution for bed preparation without tillage. The results showed him thicker layers have a more thorough and consistent impact, but some additional weed management would be needed to maintain plots weed-free. Using leaf mulch alone was not enough to shift compaction measurements in his trial in a detectable way, so he recommended using cover crops or other practices to address compaction first if this was an issue.

Site before mowing and application of treatments

Plot 1 in 2024

ACKNOWLEDGEMENTS

Scott Hortop and collaborators from the Community Compost Composers in Almonte, ON kindly provided the leaves and bags used in this trial, and helped set up the plots.

Sustainable Canadian Agricultural Partnership
Ontario
Canada
Robert and Moira Sansom Ideas Foundation
A fund within the
LONDON COMMUNITY FOUNDATION
Brian + Joannah Lawson Family Foundation
mccall macbain FOUNDATION
the McLean Foundation
Grand River Agricultural Society

EFAO ECOLOGICAL FARMERS ASSOCIATION OF ONTARIO

EFAO's Farmer-Led Research Program helps farmers combine their curiosity with scientific rigour to find practical ecological solutions, make informed decisions, and improve their farm operations.

If you are interested in conducting an on-farm trial visit efao.ca/farmer-led-research or contact research@efao.ca.