Tarping Field Study Report

Silage Tarps and Solarization Impacts on Soil Ecology, Weeds, and Crops

Tarps are increasingly used for agriculture in the northeastern USA but there are many unanswered questions about their impacts on the agroecosystem.

What we did: We studied tarps on three farms in Chittenden County, Vermont: Diggers' Mirth Farm, Intervale Community Farm (ICF), and Catamount Farm. Each farm had a different soil type, irrigation scheme, fertilizer, and baseline weed pressures (Table 1). We applied tarps from May 26 to June 21 2021, and each farm had six replicates of three treatments: silage tarp, clear plastic (solarization) tarp, and an uncovered control which was frequently hoed (Fig. 1). We measured soil temperature and moisture with soil probes that took continuous measurements, and measured soil nitrate directly before and after the tarp treatments. We sampled surface-active arthropods before, during, and three times after tarp placement using pitfall traps. Finally, we measured weed cover and crop growth weekly after tarps were removed. The climate during this experiment was hot and dry in June and cool and wet in July, compared to historical averages.

What is an arthropod?

Arthropods (like insects, spiders, spring-tails, woodlice, and more) are invertebrate animals that have exoskeletons and legs. Certain arthropods are incredibly abundant in agricultural soils. While some arthropods can be pests, most have neutral or even beneficial roles, like contributing to decomposition, creating soil structure, and acting as natural enemies to pests. Therefore, preserving these communities is important for conservation and also to promote healthy soils.

	Catamount	ICF	Diggers' Mirth
Soil type	Sandy	Sandy loam	Loam
Irrigation	Drip irrigation	Sprinklers	Sprinklers
Nitrogen source	ProBooster	Kreher 7-2-6	NatureSafe 13-0-0
Major weeds	Purslane and crabgrass	Lambsquarters and oak-leaved goosefoot	Redroot pigweed and hairy galinsoga

***Table 1**: The farms' biophysical and management characteristics*

	Control	Silage tarp	Clear plastic
Surface temperature: average and maximum	69.0°F, 109.7°F	78.0°F, 127.9°F	81.4°F, 138.3° F
Temperature 10 cm below surface: average and maximum	70.1°F, 93.87°F	75.6°F, 100.2°F	83.8°F, 118.1° F
Soil volumetric moisture	16.3%	16.6%	12.2%

Table 2: *Surface and subsurface soil temperatures and soil moisture when tarps were on fields.*

What we found: Tarps markedly increased surface and subsurface soil temperatures, with clear plastic causing higher temperatures than silage tarps (Table 2). Soil moisture results varied by farm, though in general soil moisture was lowest under clear plastic tarps (Table 2). When tarps were on the fields, diversity of soil arthropods decreased; however, diversity recovered in the weeks after tarp removal (Fig. 3A). Nitrate results varied by farm, perhaps due to different fertilizer types (Fig. 3B). Confirming farmers' experiences with tarps, we found that both types of tarps significantly reduced weed coverage (Fig. 3C). However, it should be noted that clear tarps were not effective at suppressing purslane, which grew under clear tarps during the tarp treatment. Finally, crop yields were higher in tarped treatments than in the control plots.

Takeaways:

- The key benefit of tarps is weed suppression, which may lead to crop yield gains.
- Tarps may increase soil nitrate availability, but more research is needed to confirm this trend.
- Tarps have immediate negative impacts on surface-active arthropods, but arthropods quickly recovered after tarp removal. Long-term effects on arthropods remain unclear.
- Silage tarps and clear plastic tarps had similar overall effects in our study, with one major exception: clear plastic tarps were ineffective at controlling purslane.

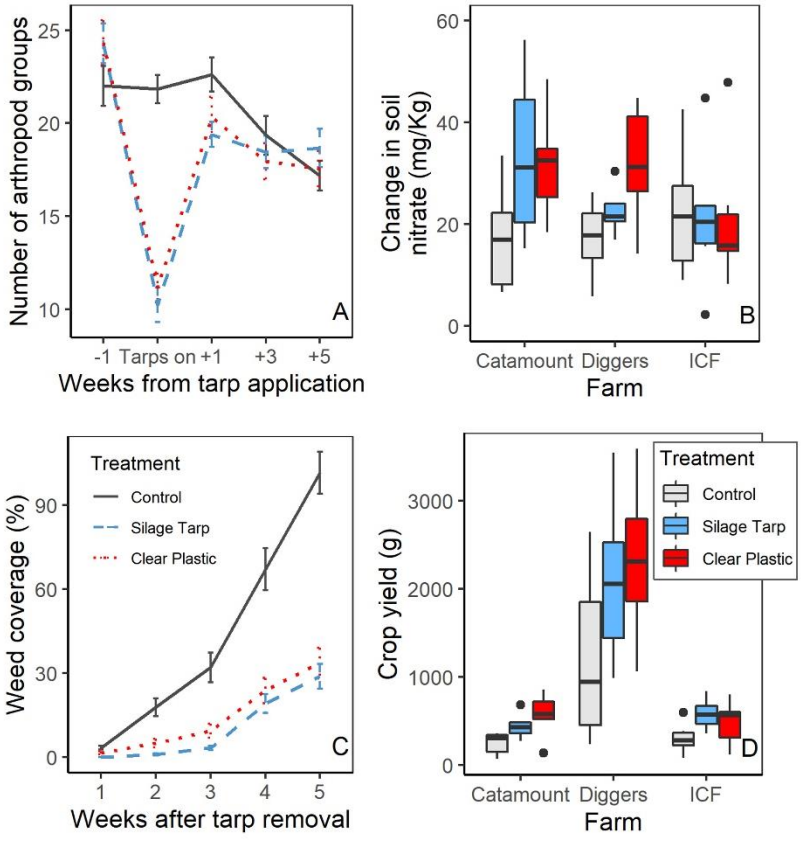

Figure 1*: Tarps' impacts on A. surface-active arthropod diversity, B. soil nitrate, C. weed coverage, and D. crop yields.*

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