EFAO 2018: Minimum tillage with tarps

Does tarping between succession plantings reduce the amount of tillage and labour required for organic salad production?

SOIL HEALTH

WEED CONTROL

Farmer-Researchers

Brent Preston
Gillian Flies
The New Farm - West

Project Timeline:
July 2018 - September 2018

In A Nutshell

With the goal of regenerative farming, Brent and Gillian want to minimize tillage for their organic salad greens production.

To do this, they trialed tarps to kill residue between succession plantings and recorded the management needed to direct seed. They also tracked labour, including time moving and placing tarps and hand weeding.

Key Findings

- Tarping soil, without tilling before tarping, reduced tillage by 82% and resulted in faster growing crops.
- It also reduced total labour 60% for lettuce and spinach crops because of fewer weeds.
- It increased total labour by 65% for mustard greens, which do not require weeding.

METHODS

Design

Brent and Gillian compared three methods of bed preparation for succession plantings of lettuce, spinach and mustard greens:

1. **Tarp without tilling first, then till or tine weed if necessary before direct seeding (minimum tillage, MT)**
2. **Till then tarp, then till or tine weed if necessary before direct seeding (till, tarp; TT)**
3. **Till and leave uncovered, and till before direct seeding (control)**

Control beds were beside the tarped beds and they planted the **same crop at the same time in all beds**.

Measurements

For each tarp placement and control, Brent and Gillian recorded management needed for bed preparation (tillage, tine weeding, nothing), weeks to harvest and approximate labour hours. At one time point, they also took measurements of soil respiration - a proxy for soil microbial activty - from tarped and tilled soil using a Solvita® Field Kit.

Table 1

Tillage scores for bed preparation in Brent and Gillian's tarp trial

Treatment	Tillage Score
No-till after harvest, tarp, till if needed (minimum tillage; MT)	0 no-till before tarp + 0.2 for tine weeding + 1 for tillage **Min 0, Max 1**
Till after harvest, tarp, till if needed (till, tarp; TT)	1 till before tarp + 0.2 for tine weeding + 1 for tillage **Min 1, Max 2**
Till after harvest, till before planting (control)	2 till before bare **Min 2, Max 2**

Tine weeding, rated here at 20% the impact of tillage, is shallow but thorough for prepping a seed bed.

RESULTS

Tillage

- Tarping beds with no tilling before and with minimum tillage after (MT) **reduced tillage by 82%**, with high statistical confidence (P<0.01; **Figure 1**).

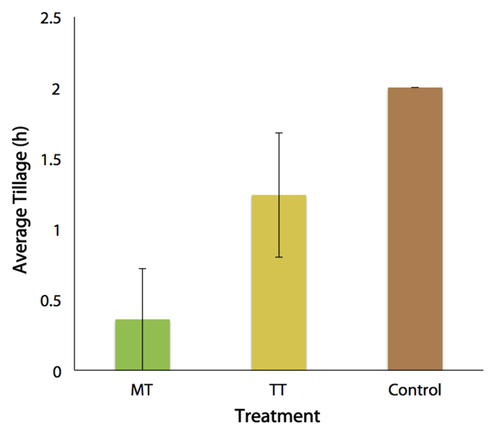

Figure 1. Average tillage for salad greens production for the two tarp treatments and control.

- Compared to tilling and tilling before tarping, all greens grew faster when soil was managed with tarps and minimum tillage (**Table 2**).
- Tilling before tarping (TT) also reduced tillage by 39%, but crops did not grow faster than control.

Table 2

Crop growth comparison for tilling before tarping (TT), no-till before tarping with minimum tillage before direct seeding (MT) and tilled control.

	Treatment	Lettuce	Spinach	Greens
Weeks to harvest	**MT**	4	3	2.5
	TT	5	4	3
	Control	5	4	3

Labour

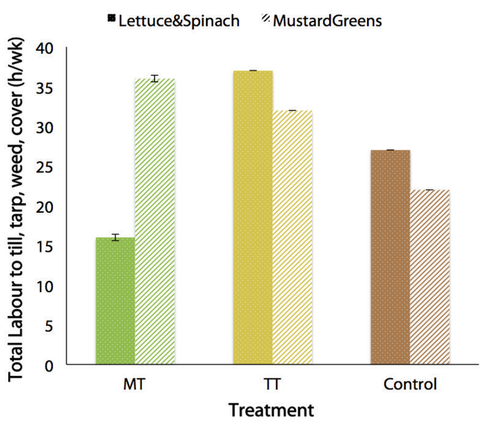

Figure 2. Total labour to grow lettuce, spinace and mustard using the two tarp treatments and control.

- For lettuce and spinach, **labour was 60% less** with minimum tillage (MT) compared to the tilled control (P<0.001; **Figure 2**).
- For mustard greens, which do not require weeding, moving tarps increased total labour by up to 65% (P<0.001).

Soil Respiration

Tarped soil: 212 +/- 77 (4 replicates)
Tilled soil: 186 +/- 71 (4 replicates)

- There was no detectable difference in soil respiration because there is a 16% (P=0.16) chance that the higher average soil respiration from tarped soil was due to chance and not to the tarp.

Top left: Soil that was tilled before tarping; **Right**: lettuce planted after tarping (left) and after tilling (right) shows the different growth rate. **Bottom left**: Lettuce stubble after two weeks under a tarp; **Right**: Spinach stubble after two weeks of tarping.

TAKE HOME MESSAGE

Tarping between succession plantings of salad greens - without tilling before tarping - is an effective way to **reduce tillage and labour and increase plant growth rate**. The reduction in labour is a result of less weeding, which Brent and Gillian posit is because weeds were solarized under the tarp. They posit that faster growing crops are a result of better soil structure from less tilling and optimal soil moisture for germination in beds that were tarped.

An impact on the soil microbial community was not evident from the data collected in this study. Further, the long-term impact of tarping is also unknown, as is a comparison of the embodied carbon in the plastic tarps vs. carbon lost via tilling.

Because of this research trial, Brent and Gillian are switching to a minimum tillage system with tarps.

Thank you to the **Trillium Mutual Roots Community Fund** for the Solvita® Field Kit.

Ecological Farmers Association of Ontario

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