



Minimizing tillage for greens with tarps and woven fabric

Farmer-Researcher(s):

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EFAO Contact

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This document outlines the steps that Brent, Gillian, Matt, Chris and Jon will follow to execute their research project, *Minimizing tillage for greens with tarps and woven fabric*, including design, execution, data collection and data sharing. It also serves as a Memorandum of Understanding between the farmers and EFAO.

Background

With the benefits of no-till agriculture systems becoming increasingly apparent, appropriate ecological methods for weed control that do not disturb the soil are needed. Brent and Gillian's 2018 research findings with silage tarps combined with Matt's uncontrolled attempts with clear plastic and observations of the weed-free soil following removal of landscape fabric suggest tarping may provide an acceptable method for weed control.

What is unclear is which of the tarping materials (silage tarp, clear plastic, woven landscape fabric) is most suitable. Tarping with clear plastic (i.e. solarization) traps solar radiation resulting in increases in soil temperature. The weeds rapidly germinate and then die due to the lethally high temperatures. Use of opaque, dark materials for tarping (i.e. occultation) induces weeds to germinate in the warm, moist soil and they die due to the absence of light. Solarization will increase soil temperatures 5-10°C more at 5 cm depth compared to occultation, which may be lethal to weed seeds but may also be detrimental to beneficial soil microbiota. The effect of the permeability of woven landscape fabric over silage tarp is unclear.

With this context, the farmers asked:

What material, silage tarp, clear plastic or woven landscape fabric, provides the greatest benefit as a means of weed control for production of organic greens and are these results consistent throughout the year?

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Experimental Design

Farmer	Treatments and control	Crops	Occultation/ solarization time	Replicates
Matt	Silage tarp* Clear plastic* Landscape fabric Light cultivation at crop termination when tarps being laid and flaming immediately prior to planting when tarps lifted	Lettuce mix Brassica greens (e.g., kale, collard, arugula, mizuna), Chenopodiaceae greens (spinach, chard, beets) Roots (carrots and beets)	Min 2 weeks	3 bed replicates x 3 succession plantings for each greens crop 3 bed replicates for the root crops x 2 succession plantings
Brent and Gillian	Silage tarp Landscape fabric Tilling after harvest to kill stubble and before seeding	Lettuce mix Mustard greens (e.g. kale, arugula and several varieties of mustards (mizuna, purple Osaka, etc) Spinach	Min 2 weeks	4 succession replicates total At least 2 lettuce, 1 spinach and 1 replicate of mustard greens
Chris and Jon	Silage tarp Landscape fabric Light cultivation (tilthing) immediately prior to seeding	Lettuce mix Baby kale Arugula		3 succession plantings for all crops combined

* Matt will bury the edges except where 2 tarps meet where they will have a 1' overlap and be held in place by continuous sand bags. Matt plans on trying to use the plow on the wheel hoe to dig a small trench, lay the tarps in then use a cement rake to cover edges.

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Matt's Design

Each block 2 beds wide, ~ 10'	~ 180'		
	60' Divided into 4 x 15' experimental plots	60' Divided into 4 x 15' experimental plots	60' Divided into 4 x 15' experimental plots
	Carrot/Beet 1 (1st Planting) Fabric, tarp, clear, control	Carrot/Beet 2 (1st Planting) Control, clear, fabric, tarp	Carrot/Beet 3 (1st Planting) Control, tarp, fabric, clear
	Lettuce 1 (1st Planting) Control, tarp, clear, fabric	Lettuce 2 (2nd Planting) Clear, fabric, tarp, control	Lettuce 3 (2nd Planting) Fabric, clear, control, tarp
	Brassica 1 (1st Planting) Clear, fabric, tarp, control	Brassica 2 (2nd Planting) Clear, tarp, fabric, control	Brassica 3 (2nd Planting) Clear, control, fabric, tarp
	Cheno 1 (1st Planting) Fabric, clear, control, fabric	Cheno 2 (2nd Planting) Control, fabric, clear, tarp	Cheno 3 (2nd Planting) Tarp, fabric, control, clear

- 15' sections are randomly assigned to one of the three treatments or the control, which will be used on the section throughout the season.
- 1st Planting = March/April; 2nd Planting = 2 weeks later, when 1st Planting is planted.
- As each crop section is terminated, it will be re-tarped or lightly cultivated (control); if crop residue is too large, the entire section will be mown prior to treatment.
- The greens crops all have multiple cuttings but the expectation is for at least 3 succession plantings per section.
- The root crops are expected to be replanted only once.
- While not possible or likely necessary for initial experimental setup, by May the experimental sections will be irrigated to field capacity prior to tarping.
- To measure temperature at 2-5 cm in each treatment type, temperature data loggers will be buried in the centre of each treatment and control in one experimental section. Additionally, a data logger will monitor ambient temperature.



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Chris and Jon's Design

	Bed 1	Bed 2	Bed 3
Succession 1: Lettuce	Randomization: Fabric, control, tarp	Randomization: Fabric, tarp, control	Randomization: Tarp, control, fabric
Succession 2: Baby kale			
Succession 3: Arugula			

- Comparison of the effectiveness and labour associated with 3 different methods' (tilthing, occultation with landscape fabric, occultation with silage tarp) to incorporate greens crops residue and control weeds
- 3 adjacent Beds measuring 100' by 48" are the study area
- In the second week of May, 2 beds will be covered (1 with landscape fabric, 1 with silage tarp) for 2 weeks prior to planting while the 3rd is left bare (to be tilled immediately before seeding)
- These beds will be planted to greens crops (arugula, lettuce, baby kale) in 3 successions in the season: Early June, Mid-July, and Early September
- All 3 will be planted to the same crop at the same time, crops will mature and be harvested before treatments will be applied again for 2 weeks before the next succession, this process repeats between each succession

Brent and Gillian's Design

- Side-by-side comparison of silage tarp, landscape fabric and control to kill salad stubble and reduce tillage.
- Condition of beds will be assessed when tarps are removed. Beds will be tilled or tine weeded (depending on level of residue) and then replanted by direct seeding immediately.
- A minimum of two replicates for lettuce, one for spinach and one for mustard.

[Evaluation Forms](#) (forms linked in separate file)

General Observations - ALL

Labour Measurements

Yield Measurements (Brent)

Soil Moisture Measurements (Matt)

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Other Measurements

1. Soil temperature using HOBO pendant data loggers

- Download data when you move the tarps
- Dig up logger and re-bury at new site
- Send data to Sarah ASAP
- Measures of Heat will be taken with Matt's methodology

2. Soil microbial communities - PENDING

- TRFLP (\$50/sample for 10+ samples) from A&L - from soil with continuous tarp treatment or control
 - 4 reps x 3 treatments = 12 + 4 x 4 = 16
- Microplastics?
- Other measurement?

Research Expense Budget

Prices are approximate; NA or in-kind for any materials that you already own or have access to. Please indicate if you intend to give any of the supplies to EFAO's Tool Library for others to use after you are finished with them.

Material	Quantity	Unit	Total Cost	EFAO's Tool Library (Y/N)
Tarp - large	2			N
Tarp - small	2			
Clear plastic , 10'x100'	1	\$69.97		N
Landscape fabric - large	1	\$1000		N
Landscape fabric - small	2 Woven landscape			



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	fabric: \$64.19 (1/3 x \$192.57) Irrigation Plus BGC10 10'x300' \$192.57			
Row bags	50	\$1.90	\$95	N
			\$1800	
Temperature loggers	10	\$75	\$1750	Y

Research Calendar

Time	Task	Action Item
Monthly	-	Sarah will email

Deadline for data, progress report and photo submission

October 15, 2019 (Chris and Jon's data may be incomplete at this time.)

Memorandum of Understanding

Please refer to efao.ca/research-mou for Memorandum of Understanding.

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Farmer-Led Research 2019:

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COMMUNITY WEED CONTROL SOIL HEALTH

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