

FARMER-RESEARCHERS

**Luke Sheldrick &  
Dana Moores**  
Terramor Farm

Terramor Farm is situated on the traditional, unceded and unsundered territory of the Algonquin people.



RESEARCH REPORT 2021

**Microclimates for summer lettuce**

**IN A NUTSHELL**

To find a system for growing consistent lettuce in the heat of the summer in eastern Ontario, Luke and Dana compared different methods of altering the microclimate for lettuce including black landscape fabric (control); white landscape fabric, and white landscape fabric with shade cloth.

- Luke and Dana did not have the statistical power to detect differences in lettuce yield among treatments.

- From their observations, they will grow more mid-summer lettuce to help increase quantity available; and they will grow it on white landscape fabric to help with quality.
- They will continue to use black fabric during the spring and fall.
- They also plan to continue to experiment with shade cloth for 1-2 weeks post transplant during peak heat.

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**MOTIVATION**

Mid-late summer is a hard time to grow lettuce in southern Ontario, due to hot temperatures. Luke and Dana want to try a combination of landscape fabric and shade cloth to create microclimates to reduce heat and grow consistent summer lettuce.

For salad production, yields have always dropped from mid-August to mid-September, which is the hot summer July 15-August 15 planting window. With salad being one of Terramor Farm's most sought after and profitable crops it is detrimental to their sales to have a lull in production for salad greens. This also means Luke and Dana's goal is to offer salad consistently in all of their sales avenues from early May straight through to October. In order to do this, they need to solve the mid-summer growing issues.

**METHODS**

Treatments

Using pre-mixed Salanova (50% green crisp and 50% all other varieties), Luke and Dana planted lettuce transplants in 100' beds with overhead irrigation, Luke and Dana took measurements on two plantings of lettuce with two beds each of three treatments:

**Black landscape fabric with no shade cloth (B)**

- Control treatment
- Function: Weed barrier

**White landscape fabric (W)**

- Microclimate treatment
- Function: Potential weed barrier, soil temperature moderation

**White landscape fabric with shade cloth for first 2 weeks post transplant (WS)**

- Microclimate treatment
- Function: Potential weed barrier, soil temperature moderation and heat/light reduction

Luke and Dana were uninterested in a control with no landscape fabric, because of previous experience comparing lettuce with and without fabric when they observed benefits with respect to moisture retention with landscape fabric.



**Photo 1.** Justine harvesting lettuce for the trial. Notice the comparable size of lettuce grown in black fabric in Photo 3.

They secured fabric with 8" ground staples and installed shade cloth using EMT conduit (one piece cut and then welded to make 12' lengths, inserted into rebar) to cover 2 beds. They then covered the hoops with 12' wide shade cloth (2x6' wide pieces zip tied together) and used twine over each hoop to fix the shade cloth down to the hoops - similarly to how rope is used on a caterpillar tunnel.

### Experimental Design

As shown in **Figure 1**, Luke and Dana assessed different microclimates for summer lettuce as follows:

**Planting 1:** Treatments **B & W** over 2 beds, for 1 cutting each - seeded June 26, transplanted - July 23

**Planting 2:** Treatments **B, W, WS** over 2 beds, for 2 cuttings each - seeded July 8, transplanted August 5

Luke and Dana also originally planned to repeat the trial across three dates, but the first date was a little too busy on the farm to get it done properly. Nevertheless, it worked well as a trial run for them to work out the kinks of recording the data properly.

They recorded bed feet harvested and total weight of lettuce from each section.

### Land Preparation

Luke and Dana grew both plantings on the same land that they amended with a mix of organic pelletized chicken manure and alfalfa/kelp meal at a rate of 50 lbs/acre, along with micronutrients according to a fall soil sample.

### DATA ANALYSIS

To evaluate the effect of treatment on yield by weight, we used a statistical model called analysis of variance (ANOVA) with a 90% confidence level to calculate the least significant difference (LSD) needed to call the treatments "statistically different". We also tested the effect of yield using a T-test with a 90% confidence level.

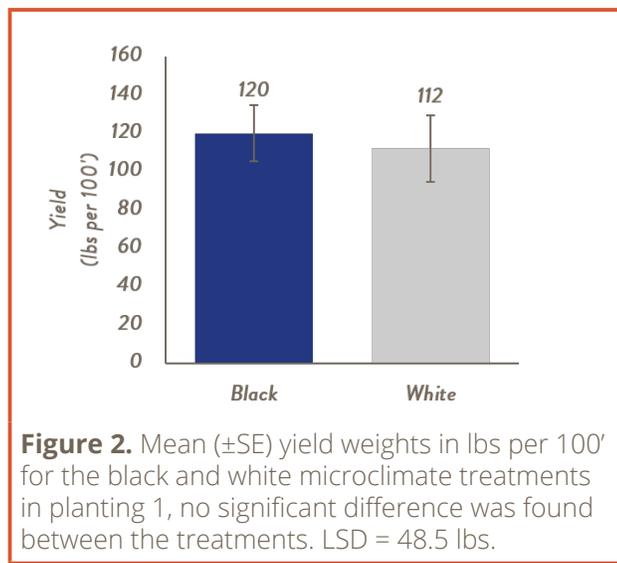
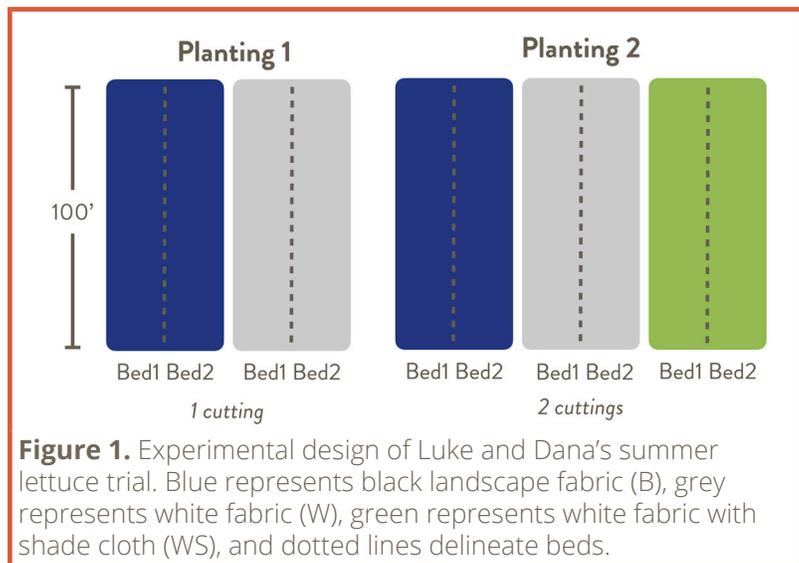
Using a 90% confidence level means that if we measure a difference between any two treatments that is greater than the calculated LSD, we expect this difference would occur 9 times out of 10 under the same conditions. In this case, we consider the difference reliable and refer to the results as statistically significant. On the other hand, if we measure a difference between any two treatments that is less than the calculated LSD, we consider these treatments unreliably different or statistically similar. We could make these statistical calculations because the experimental design involved replication of treatments (**Figure 1**).



**Photo 2.** Spring planting grown in side-by-side plots with B and W landscape fabric. This planting acted as a practice to improve harvest methods for good record keeping.



**Photo 3.** Robert harvesting lettuce for the trial. Notice the comparable size of lettuce grown in white fabric in Photo 1.



## FINDINGS

### Yield

For yield by weight per 100' in planting 1, they needed to see an LSD of 48.5 lbs between the black and white landscape fabric in order to assess these treatments as different. With an observed difference of 8 lbs, they found there was no statistically significant difference in yield weight per 100' ( $P=0.73$ ) between black and white landscape fabric in planting 1 (Figure 2).

In planting 2, Luke and Dana needed to see an LSD of 35.4 lbs between any two of the three treatments in order to assess the treatments as different. They found no statistically significant difference in yield weight among the three treatments ( $P=0.39$ ; Figure 3).

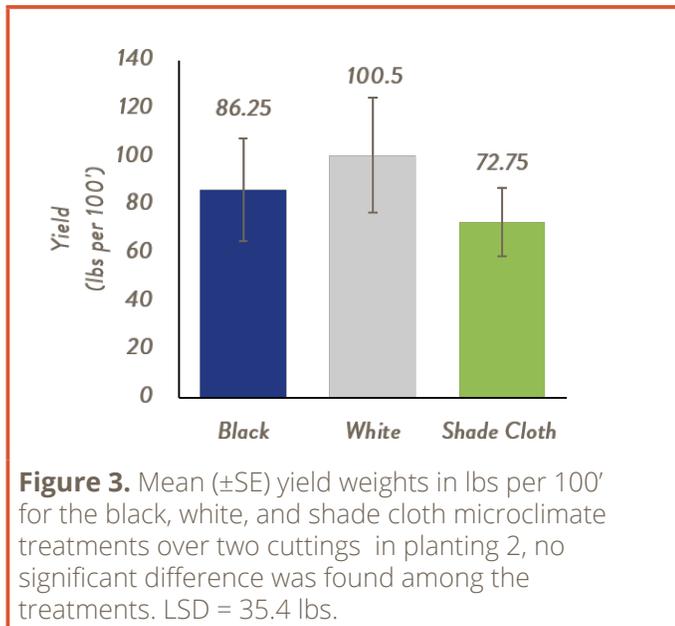
### Soil Temperature

Luke placed HOB0 Pendant® MX Water Temperature Data Loggers w/Bluetooth 5 cm below the soil surface under white fabric, black fabric, and white fabric with shade cloth. However, the loggers were not calibrated properly and failed to collect reliable data.

### Other Observations

The lack of detectable differences may be due to lack of statistical power because of too few replicates. Luke and Dana observed a lot of variability in yield within the treatments which made it hard to tease apart any potential treatment differences. For white fabric specifically, they noticed more variability in head size during colder months.

Despite the variability, there was a trend towards lower yields in the shade cloth treatment. However, their observations make them think quality might be higher with white fabric and/or shade cloth.



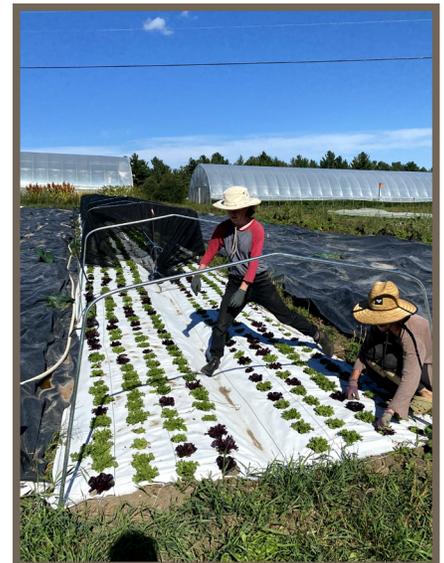
**Figure 3.** Mean ( $\pm$ SE) yield weights in lbs per 100' for the black, white, and shade cloth microclimate treatments over two cuttings in planting 2, no significant difference was found among the treatments. LSD = 35.4 lbs.

They also observed that black landscape fabric inhibits the growth of weeds under it, while weeds continued to flourish under the white landscape fabric including the pathways. When using white fabric, therefore, Luke and Dana suggest using fabric that is single bed width so that you can cultivate pathways.

- Moving forward, they will be putting more energy into ensuring that transplants are kept cool during the hotter months. They will place them in a partially shaded spot and water the lettuce 3 times/day and see if this helps.

## CAVEATS

- It was a really hot and dry August, and Luke and Dana drained their pond keeping up with irrigation on the lettuce.
- The farmers suspect some of their yield issues come from poor quality transplants, as suggested by variability of size of the salad within the bed. This variability was likely not related to irrigation because size was inconsistent across all beds and all areas of the beds (vs specific areas where overhead irrigation may not be reaching).
- They have noticed inconsistent head size is more common for summer plantings than the spring and fall plantings.



**Photo 4.** Paula and Molly about to take the shade cloth off.

## NEXT STEPS

Luke and Dana will continue to use the white landscape fabric for their mid-summer plantings and use the black fabric for spring and fall plantings.

They will also continue to experiment with placing shade cloth over greens for the first 1-2 weeks after transplant for the July 1 - August 30 plantings, based on the temperatures at the time; and work on transplant quality (see **Caveats**). They are also going to plant more salad during this period. For example, they planted 50% more salad starting July 1, which helped recover production loss during the hot months, and also allowed for extra greens to be in the field in the fall when growth slows and it can sit until it is needed.



**Photo 5.** With shade cloth off! The lettuce under shade cloth appeared to be larger than the uncovered but, at maturity, grew less dense resulting in much less yield.



**Photo 6.** Lettuce grown under shade cloth after the cover came off, with a hand for scale.

## TAKE HOME MESSAGE

There was not enough data to detect a difference in yields among treatments. From observations, Luke and Dana noted that salad yields in August and September seemed to improve using methods in the trial — and observed a difference in quality of mid-summer lettuce grown on white landscape fabric — but still aren't anywhere close to the same yield/sq ft as the spring or fall.