

FARMER-RESEARCHER

**Jeff Boesch**  
Cedar Down Farm

Cedar Down Farm is located on land that is part of the Three Fires Confederacy of the Ojibwe, Odawa and Potawatomi.



RESEARCH REPORT 2021

**Shallow vs deep tillage in permanent beds for onions**

**IN A NUTSHELL**

To test whether permanent beds can grow onions well with only shallow tillage (1.5 inches) as compared to deep and shallow tillage.

- Jeff found no difference in onion yield (weight) between the tillage treatments.

- Seeing no adverse effects from using only shallow tillage gives Jeff confidence to try more minimum tillage for bed preparation in the future.
- Yankee variety outperformed Norstar by an average of 20% more by weight.

This trial was funded through the Living Lab-Ontario project to help support knowledge transfer of innovative practices. Funded by Agriculture and Agri-Food Canada (AAFC), this initiative has farmers and federal scientists from AAFC and Environment and Climate Change Canada studying soil health and water quality on real farms.

**MOTIVATION**

Systems for growing no-till vegetables often use a broadfork to loosen up the soil after winter and before planting. For this reason, Jeff has been wary of only doing really shallow seed bed-type tillage with no deeper tillage to loosen and warm the soil after the snowpack in spring. In 2021, however, conditions in Jeff's permanent beds were right to compare shallow and deep tillage — there was little-to-no winter annual or perennial weed pressure and radish tap roots of the cover crop grew well (**Photo 1**).

**METHODS**

Jeff has 8 permanent beds that he used to grow yellow storage onions in 2021. To prepare the beds, Jeff seeded the beds to tillage radish in August 2020.

To test the difference between shallow + deep tillage and shallow tillage only, Jeff used the following randomized design (**Figure 1**).

Each bed was 200 ft long and 5 ft wide on the centre of wheel paths. Jeff grew onions in clumps of 2 or 3 plants every 12 inches in 3 row beds with 13 inches between rows, meaning he had approximately 1200 onion plants per bed.

When he prepared the beds in the spring (**Photo 2**), he identified the beds by marking the ends of the bed with flags.

At harvest, Jeff picked sections of 25" each from which to weigh harvested onions for data collection (**Photos 3-5**).



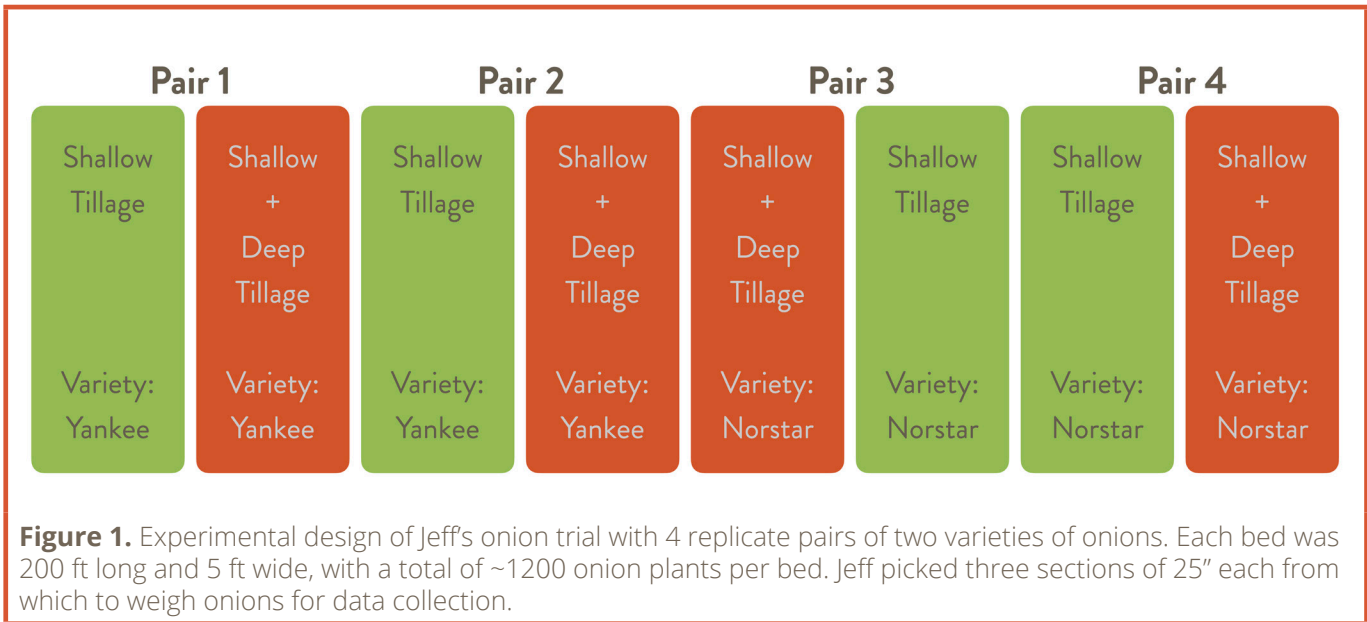
**Photo 1.** Tillage radish in the permanent beds after winter.



**Photo 2.** Bed prep in the shallow and shallow and deep tilled beds.



**Photo 3.** Onions growing in Jeff's trial.



### DATA ANALYSIS

To evaluate the effect of treatment on yield 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".

Using a 90% confidence level means that if we measure a difference between the 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 Jeff's experimental design involved replication of the treatments (**Figure 1**).



**Photo 4.** Jeff's team harvesting 25ft sections of onions



**Photo 5.** Jess weighing onions for the trial!



**Photo 6.** A side-by-side image of onions growing foliage in beds without (left) and with (right) deep tillage.

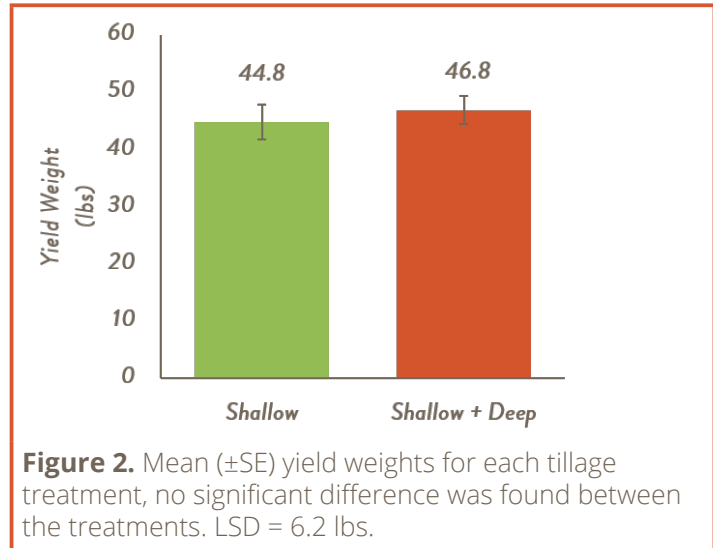
### FINDINGS

For yield by weight, Jeff needed to see an LSD of 6.2 lbs between the shallow and shallow + deep tillage treatments in order to assess these treatments as producing different yields. With an observed difference of 2 lbs, Jeff found there was no statistically significant difference in yield weight ( $P=0.59$ ) (**Figure 2**).

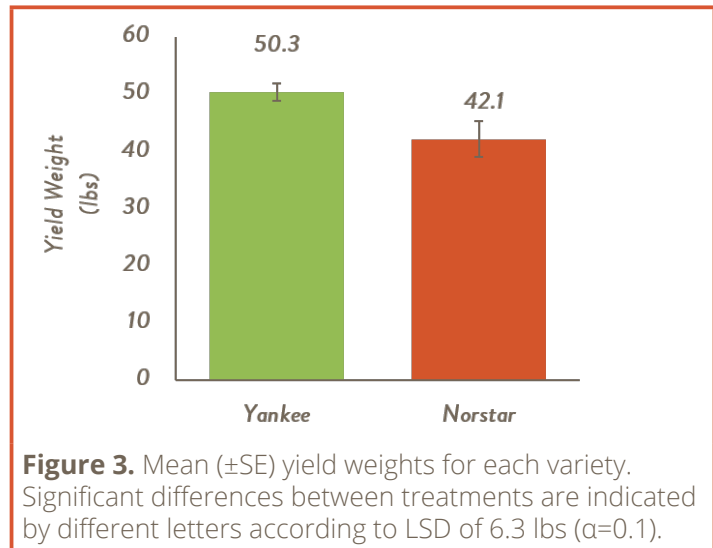
Jeff did find a significant difference between the two varieties of onions grown ( $P=0.02$ ), in which the Yankee variety produced significantly more yield weight when compared to the Norstar variety (**Figure 3; Photo 6**). He needed an LSD of 6.3 lbs between varieties and he observed Yankee weight had an average of 8.2 lbs more per plot.

### NEXT STEPS

“Knowing that there were no adverse effects on early spring crops that were planted into soils barely worked helps me feel confident trialing more minimum tillage for bed preparation in the future”, Jeff says.



**Figure 2.** Mean ( $\pm$ SE) yield weights for each tillage treatment, no significant difference was found between the treatments. LSD = 6.2 lbs.



**Figure 3.** Mean ( $\pm$ SE) yield weights for each variety. Significant differences between treatments are indicated by different letters according to LSD of 6.3 lbs ( $\alpha=0.1$ ).

### TAKE HOME MESSAGE

Jeff concludes that “the onion plants in the shallow tilled ground seemed just as happy throughout the season and yielded just as well as the ones in the deeper worked ground. Any difference in soil density or soil temperature didn’t seem to bother this early spring crop”. The cover crop of tillage radish before onions may have contributed to the success of using only shallow tillage.