

RESEARCH REPORT

No-till fall broccoli in northern Ontario

Farmer-Researchers

Ryan Spence & Isabelle Spence-Legault
Field Good Farms / J'me Champ Bien
West Nipissing County

IN A NUTSHELL

Ryan and Isabelle tested whether a crimped cover crop of rye and hairy vetch reduced tillage, cultivation and irrigation for their fall broccoli crop.

- Compared to tillage, the cover crop residue provided sufficient mulch to significantly reduce weeding time and increase soil moisture throughout the growing season by 11%. There was adequate rainfall, so they didn't need to use irrigation in the tillage plots.

- Broccoli grown in crimped cover crop mulch had around half the marketable yield compared to the tilled plots.
- The yield loss combined with no difference in total labour made this no-till system as tested unviable for broccoli production.

MOTIVATION

Rolling or mowing high-residue cover crops can provide a mulch that both suppresses weeds and retains soil moisture. Vegetable (and grain) crops can then be direct-seeded or transplanted, eliminating the need for tillage and reducing the need for irrigation. These systems can be especially successful for vegetable crops that are later-planted and are not negatively affected by the soil cooling effect of mulch, such as pumpkins, squash and broccoli (references 1 & 2).

With this strategy in mind, Ryan and Isabelle tested a crimped between high-residue. cover crop of rye and hairy vetch as mulch for no-till fall broccoli in northern Ontario.

DESIGN

To do this, they set-up a randomized complete block design with 4 replicates, as shown in **Figure 1**.

	50'	50'
Row	Crimped cover crop	Tillage
Row 2		
Row 3		
Row 4		

Figure 1. Experimental design to assess no-till broccoli. Ryan and Isabelle divided 4 beds in half and randomly assigned each half to grow fall broccoli using tillage (brown) or a mulch of high residue rye and hairy vetch as mulch (green).

In the **tillage** plots, they seeded 6 rows/bed each of 167 lbs/acre peas + 50 lbs/acre oats on August 20, 2019 using three Earthway planters strung together with the small peas plate for peas and the chard plate for oats. The cover crop winter-killed, and they tilled twice using a walk-behind tiller before transplanting the fall broccoli and installing drip irrigation. They installed irrigation because they initially planned irrigate the control plots. However, they got adequate rainfall and never irrigated.

In the **crimped cover crop** plots, they seeded 3 rows/bed each of 110 lbs/acre rye + 20 lbs/acre hairy vetch on August 26, 2019 (**Photo 1**). For the rye, they used three Earthway planters strung together with the chard plate; and for the hairy vetch, they used a Jang, XY24 roller, rear gear #11 and front gear #10. This cover crop over-wintered and grew in the spring. Ryan and Isabelle's father built a crimper using a disassembled crimper from an old



haybine (**Photo 2**). They modified the crimper to fit onto the pallet forks of a tractor. The rye and hairy vetch was crimped on June 14, 2020 (**Photo 3**). However, the crimping was too early so they crimped again on July 10. Ryan noted that it would have worked to only crimp on July 10.

They seeded Covina broccoli in their greenhouse on June 15 and transplanted it in all plots on July 16. Transplants were set at 18" between plants in row, 2 rows per bed, 20" between rows. After transplant, they covered all beds with Protek Net 25g to control swede midge, flea beetle, cabbage moth, etc. They installed the netting with 74" wire hoops placed every 6' and offset from one bed to the next, and secured the netting by burying the edges with a shovel and placing 4 sandbags at each end for tightness. See **Photo 4** for a progression of their trial.

In each plot, Ryan and Isabelle recorded labour hours required to seed the cover crop, prepare the beds or crimp the cover crop, transplant broccoli, weed, fertilize and harvest. They also took notes on week pressure and measured soil moisture and total harvestable yield.

FINDINGS

Labour

Total labour to grow fall broccoli was similar but labour was distributed differently using tillage and the crimped cover crop, as seen in **Figure 2**.

Ryan noted the potential for the crimped cover crop to be even less laborious at a field scale - if the research plots weren't there. For example, when crimping he had to back the tractor up over the bed and reposition.



Photo 1. Seeding the rye cover crop in August 2019 using three Earthway planters strung together.



Photo 2. The crimper Ryan made using a disassembled crimper from an old haybine that they modified to fit onto the pallet forks of a tractor. For a full video of the crimper in action, visit: efao.ca/no-till-fall-broccoli-2020.



Photo 3. (Top-bottom) (a) Before and **(b)** after crimping the rye and hairy vetch cover crop on June 14, 2020.

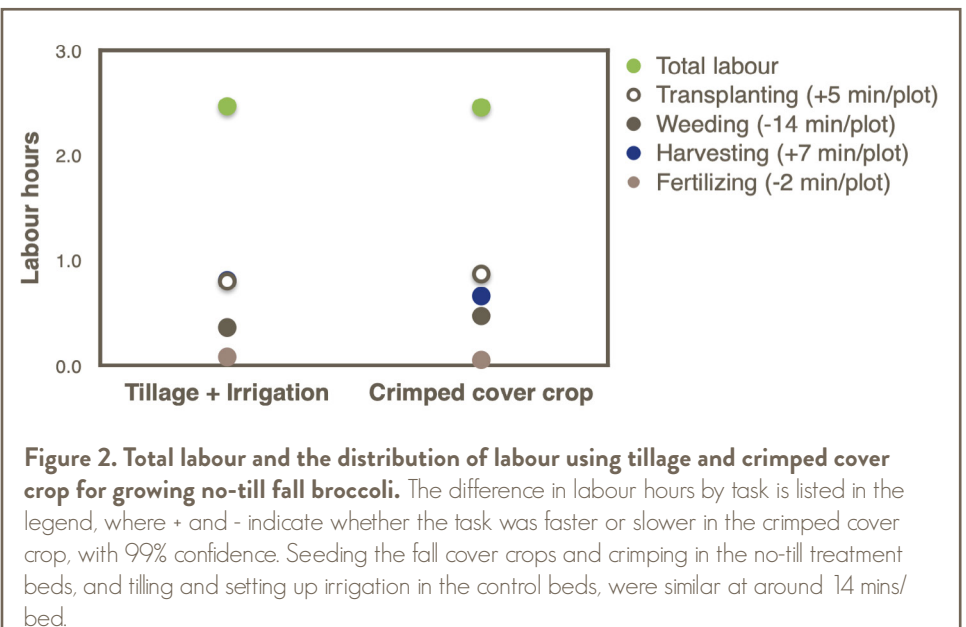




Photo 4. Progression of the trial (**top-bottom**): (a) fall cover crops growing in all plots, October 2019; (b) broccoli transplanted into crimped cover crop and tilled control plots with irrigation lines on July 21, 2020; and (c) broccoli growing in all plots, October 2020.

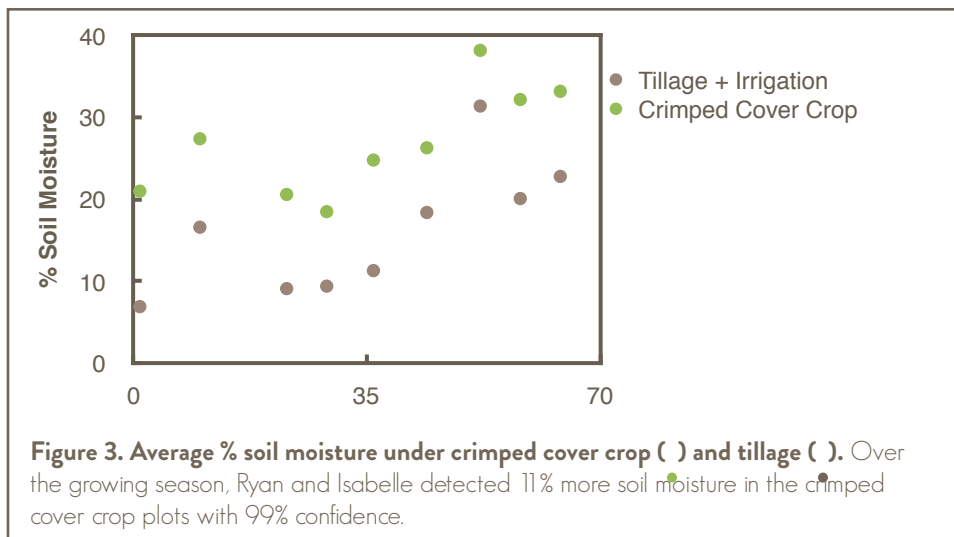
Yield

Ryan and Isabelle harvested most of the broccoli on October 1 and any remaining heads on October 8. For the first harvest, they combined all heads from replicate plots for a cumulative yield for the crimped cover crop treatment and tilled control. Without data on yield from each plot, we are unable to run statistics.

REFERENCES

1. eOrganic, Organic High Residue Reduced-Till Pumpkin Production: Weed Em and Reap: <https://www.youtube.com/watch?v=gspMfZMbZK4&list=PLB4AE9DB8C30652F3&index=18>.
2. eOrganic, Organic High Residue Reduced-Till Broccoli Production: Weed Em and Reap: <https://www.youtube.com/watch?v=4SRyB8mBEV8&index=21&list=PLB4AE9DB8C30652F3>.

This project was funded by the Canadian Agriculture Partnership, a five-year federal-provincial-territorial initiative, and FedNor.



Still, Ryan and Isabelle consistently observed that the number of heads was similar between the treatment and the control. They also observed that the crimped cover crop treatment, however, produced smaller heads resulting in around half the yield of marketable head equivalents. The difference in cover crop species between the tilled and no-till treatments could also have influenced results.

Soil Moisture

Using a Delta-T Devices, Ltd. SM150T Soil Moisture Sensor, Ryan and Isabelle measured soil moisture nine times between July 14 and September 9. At every date, there was more soil moisture in the crimped cover crop plots than the tilled plots, as seen in **Figure 3**. Ryan noted that they had adequate rainfall and never irrigated the control crop.

Weed Pressure

Ryan and Isabelle observed more annual weeds associated with tillage and more perennial weeds, specifically dandelion, associated with the crimped cover crop treatment.

TAKE HOME MESSAGE

While the crimped cover crop of rye and hairy vetch provided sufficient mulch to significantly increase soil moisture and total labour was not different, yield loss made growing no-till fall broccoli in a bed of crimped rye and hairy vetch less profitable compared to using tillage.

NEXT STEPS

Ryan and Isabelle's results are counter to successes by others like Ron Morse with no-till broccoli. They will not try this specific system again, but observations from this trial make them curious to answer a few follow-up questions:

- Would additional compost or other organic fertilizer boost the head size of broccoli grown in crimped cover crops?
- Is a rye-crimped cover crop for fall broccoli production better suited to gardens that have been no-till for longer vs. the first year of no-till?