

What is the impact of harvesting cover crops on soil and on the following cash crop?

Ontario livestock farmers are growing annual cover crops to provide supplemental forage. Oats (Figure 1) or oats and peas is a popular choice for a fall harvest, while cereal rye is a common selection for spring harvest due to its winter hardiness and early-season growth. There are proven soil benefits to traditional, non-harvested cover crops, but are these lost when the crop is harvested? And what is the impact of annual forage harvest on the following cash crop?



Figure 1. A stand of cover crop oats prior to harvest.

Impact of harvested cover crops on soil properties

Aboveground residue is a large contributor to the soil health benefits of cover crops. Residue helps protect soil from wind and water, improve soil structure and build soil organic matter. When it's removed, does the cover crop still provide a soil benefit?

Although the research is limited, most studies have found that harvesting cover crops has little or no effect on soil properties compared to not harvesting. For example, an Ontario trial from the 1980s found that harvested rye in a corn silage system (e.g. Figure 2) did not impact wet aggregate stability - a measure of how well soil aggregates resist falling apart when wetted - or bulk density - an indicator of compaction - relative to a non-harvested cover crop after three years. A Kansas study found no difference in

water or wind erosion potential or water infiltration compared to a non-harvested cover crop.



Figure 2. Spring harvest of cereal rye forage.

Recent research in Nebraska evaluated a harvested vs. non-harvested multi-species cover crop mix seeded in between continuous corn silage crops. After three years, the soil with the harvested cover crop did not show any difference in soil compaction compared to where the cover crop was not harvested, nor did it differ in terms of wet aggregate stability. It did, however, have a reduced water infiltration rate - this makes sense, as there was less surface residue to slow water down. It also had slightly lower soil organic matter relative to where the cover crop was left unharvested.

Cover crops taken for forage provide soil health benefits, but not always to the same degree as those that aren't harvested. Cover crop roots, which strongly contribute to stable organic matter and soil structure, help harvested forages hold their own in terms of soil improvement.

Effects of harvested cover crops on the following cash crop

Harvesting a cover crop for forage can negatively impact the following cash crop primarily through soil moisture depletion and nitrogen tie-up. This is specifically of concern for winter cereals prior to corn. A two-year Minnesota trial found that rye harvested at the boot stage resulted in 26 and 28-mm reductions in soil water storage over two separate seasons. Also, it removed a large amount of nitrate-nitrogen, which affected corn yield. Non-harvested rye - killed chemically several weeks before corn planting - did not deplete soil

moisture or decrease corn yield. Ontario research also found that rye grown for feed in advance of corn silage can reduce yield, as well as potentially delay planting. Total yield (rye + corn), however, exceeded corn-only yield when there was spring tillage.

The impact of cover crop harvest depends on the following crop. Michigan research found that while grain or silage corn yields following double-crop rye were negatively impacted, soybeans yields were not. Work in New York state also found soybeans to yield similarly after cover crop rye forage harvest compared to a plow-down or no cover crop.

Other considerations

- Like any harvested crop, cover crops taken for forage will remove nutrients. It's important to account for this removal, especially for phosphorus and potassium, in the farm's nutrient management planning.
- The management of fall-harvested oats is typically simpler than an over-wintering fall cereal. If new to harvesting cover crops for forage, start with oats.

Bottom line

Harvesting cover crops for forage slightly diminishes their soil benefits, but still provides soil health improvement relative to not seeding a cover crop. It can also provide an immediate economic payback. Roots play an important role in soil improvement when cover crops are harvested.

References

Blanco-Canqui, H., J.D. Holman, A.J. Schlegel, J. Tatarko & T.M. Shaver. 2013. Replacing fallow with cover crops in a semiarid soils: Effects on soil properties. [Soil Science Society of America Journal](https://acsess.onlinelibrary.wiley.com/doi/abs/10.2136/sssaj2013.01.0006) <<https://acsess.onlinelibrary.wiley.com/doi/abs/10.2136/sssaj2013.01.0006>>, 77, 1026-1034.

Blanco-Canqui, H., M. Drewnoski & D. Rice. 2020. Does harvesting cover crops eliminate the benefits of cover crops? Insights after three years. [Soil Science Society of America Journal](https://acsess.onlinelibrary.wiley.com/doi/epdf/10.1002/saj2.20175) <<https://acsess.onlinelibrary.wiley.com/doi/epdf/10.1002/saj2.20175>>. 85:146-157.

Crowley, K.A., H.M. Van Es, M.I. Gomez & M.R. Ryan. 2018. Trade-offs in cereal rye management strategies prior to organically managed soybean. [Agronomy Journal](https://onlinelibrary.wiley.com/doi/full/10.2134/agronj2017.10.0605) <<https://onlinelibrary.wiley.com/doi/full/10.2134/agronj2017.10.0605>> . 110:1492-1504.

Krueger, E.S., T.E. Ochsner, P.M. Porter & J.M. Baker. 2011. Winter rye cover crop management influences on soil water, soil nitrate, and corn development. [Agronomy Journal](https://onlinelibrary.wiley.com/doi/abs/10.2134/agronj2010.0327) <<https://onlinelibrary.wiley.com/doi/abs/10.2134/agronj2010.0327>> . 103:316-323.

Raimbault, R.A., T.J. Vyn & M. Tollenaar. 1990. Corn response to rye cover crop management and spring tillage systems. [Agronomy Journal](https://onlinelibrary.wiley.com/doi/abs/10.2134/agronj1990.000219620C) <<https://onlinelibrary.wiley.com/doi/abs/10.2134/agronj1990.000219620C>> . 82:1088-1093.

For more information:

Toll Free: 1-877-424-1300

E-mail: ag.info.omafra@ontario.ca