BC FoodWeb

Peer-reviewed research

Under cover: What black winter tarps do to farm soils

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KEY TAKEAWAYS

Establishing overwinter cover crops can be difficult under cold, wet fall conditions. Researchers studied how black tarps can be a useful alternative for protecting soil when cover crop establishment is not possible. The study found:

- Black tarps increased nitrate and soil moisture in the spring compared to both overwinter cover crops and bare ground.
- Black tarps were successfully adapted across different farm contexts depending on soil type, management goals, and regional climate.

Production Type

- Mixed vegetable farms

Practice Benefit(s)

- Nutrient and water management

Research Location

- Lower Fraser Valley, BC
- Vancouver Island, BC
- Kootenay Mountain, BC

Key Terms

- *Plant available nitrogen:* The leftover fruit material like skins, pulp, and seeds, after juice has been squeezed out or the fruit has been processed.
- *Cover cropping:* The practice of planting non-cash crops in production fields after the growing season to improve soil health, reduce erosion, enhance soil fertility, and protect fields during the winter months.

How can this research be used?

Black tarps can be an important overwinter tool for small-scale organic growers in BC. **Growers can use black tarps to preserve plant available nitrogen over the winter and influence soil water in the spring. Also, tarps are adaptable and can be placed when and where they are most needed.** For farms with mixed soil types, this may include using tarps on sandier areas that lose water more easily. While tarps do not replace the long-term benefits of cover crops, they offer a practical alternative when fields would otherwise remain bare. In these situations, tarps can help with nutrient leaching that is beneficial for both production and the environment.

Why was the research done?

Researchers compared overwinter tarp to cover crops and bare ground to understand how each option affects soil nitrate, moisture, and yield. The goal was to give BC vegetable growers alternatives for protecting soil when cover cropping isn't possible.

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Overwinter cover cropping is common on mixed vegetable farms in BC. Cover cropping prepares the soil for the next growing season by capturing left over nitrogen, improving nutrient cycling, and protecting soil from rainfall. However, it is not always possible to plant cover crops in time. Heavy rainfall can limit equipment access and shorten the already narrow fall planting window. When planting is delayed, the cover crop does not have enough time to develop root systems before cold weather arrives, so it cannot hold soil in place well or take up nitrogen effectively.

Rather than leaving fields fallow, black plastic tarps were tested to see if they could be used as an alternative. These opaque tarps are thick, impermeable, and UV resistant for up to 10 years. They help keep excess rain out of the soil, which reduces nitrogen losses from runoff.

What was the outcome?

Black tarps were tested on two types of farms: research farms and working farms. Research farms provided controlled conditions to measure how tarps affected nitrate, soil moisture, and crop yield. Working farms represented a wider range of landscapes, climates, and management practices, helping evaluate whether the results would hold under real-world farming conditions.

Across both farm types, nitrate was higher under black tarps than under cover crops or bare ground when measured in the spring (March-April) after tarps were removed but before the cover crops were mowed. Nitrate ranged from 19–40 kg/ha under tarps compared with 2–20 kg/ha in cover cropped fields, making levels approximately 2–8 times greater under tarps. **This increase could be agriculturally significant in early spring by reducing the need for additional fertilizer.** For example, the highest PAN levels measured under tarps could supply nearly 70% of the recommended soil nitrogen requirement for beet production.

Soil moisture varied among farms and years. In general, cover-cropped soils retained more water during much of the winter, while tarped soils often had higher moisture levels in early spring. Growers can manage this effect by adjusting the time of tarp removal. For example, farms with sandy (coarser) soils may want to leave tarps longer to hold moisture, while farms with heavier (finer) soils may remove them earlier to let excess water dry out.

Black tarps did not affect crop yields in the research trials, although yield was only measured on the two research farms in 2020. **Participating farmers also reported practical benefits, including reduced weed pressure, easier field preparation, and lower labour requirements before planting.**

Figure 1. Cover crops and tarps in the spring at UBC farm (top), a regional farm in the lower mainland (middle), and a soil probe used to measure soil moisture (bottom). Photos by R. Kesler.

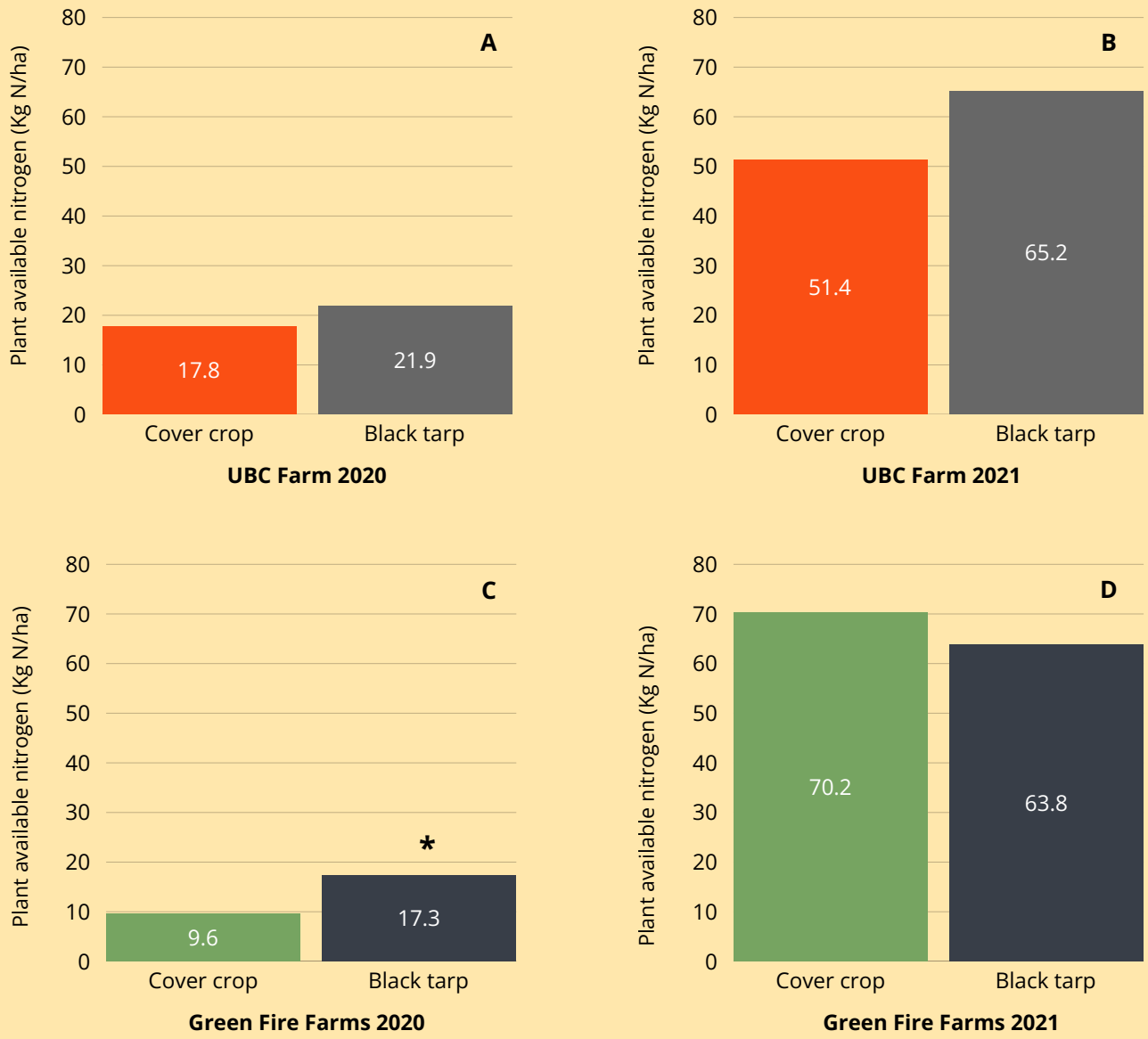

Figure 2. These graphs show the average amount of nitrate in the soil (kg N/ha) measured in spring after harvest under overwinter cover crop and black tarp treatments at the University of British Columbia (UBC; n = 16; A, B) and Green Fire Farm (GRF; n = 16; C, D). Asterisks (*) show where the treatments resulted in significantly different levels of available nitrate for plants.

What's next?

Black tarps could offer growers a flexible winter option when cover crops cannot be established, but their full costs and benefits are still being explored. Future research will help determine how tarps influence labour, input costs, and farm profitability. Also, developing effective recycling pathways for agricultural plastics will be another important step toward improving the sustainability of this practice.

How was the research done?

We conducted this study during the winters of 2019–2020 and 2020–2021 on 14 mixed vegetable farms across British Columbia. The study included both research farms and working farms.

The research farms were located in Vancouver and Duncan, BC. These sites allowed us to control field conditions and measure how black tarps affected soil nitrogen, soil moisture, and crop yield. We also worked with 12 commercial farms across Vancouver Island, the Fraser Valley, and the Kootenay mountains. These farms represented a range of soil types, climates, and management practices, allowing us to evaluate tarp performance under real-world farming conditions.

At the research farms, we compared black plastic tarps with overwinter cover crops. The cover crop treatment consisted of a mixture of fall rye and crimson clover planted in the fall. At the working farms, black tarps were compared with each farmer's typical winter management practice, which included cover crops, bare soil, or crop residue.

On all farms, tarps were installed between September and November, with the black side facing upward and secured with weights. Tarps were removed between March and May. At the research farms, soil nutrients and moisture were monitored throughout the winter, while at the working farms these measurements were collected at the time of tarp removal in the spring.

We measured:

- **Plant available nitrogen (PAN):** This includes nitrate and ammonium, which is the available form that plants can use. It does not represent all the nitrogen in the soil. We measured this by collecting soil samples throughout the winter on research farms, and at the time of tarp removal on the working farms.
- **Soil moisture:** This is the amount of water in the soil. We measured it with a soil probe throughout the winter only on research farms.
- **Crop yield:** The weight of marketable crops harvested from each treatment. Crop yield was measured only at the research farms during the 2020 growing season.

Figure 3. A soil sample from spring cover crop on Vancouver island. Photo by R. Kesler.

About this brief

This brief was prepared by Nisa Chavez from the BC Food Web team, with the help of Raelani Kesler, and is based on the following scientific journal article:

- Kesler, R., Borden, K., Li, C., Lewis, D., Krzic, M., Grayston, S., & Smukler, S. M. (2026). Black plastic tarps as overwinter soil cover influence soil nitrogen and soil water content on farms in british columbia. Canadian Journal of Soil Science, 106, 1-14. https://doi.org/10.1139/cjss-2025-0072.

Want to learn more?

- For any questions regarding this research, contact Raelani Kesler at raelani.kesler@ubc.ca.

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