THE UNIVERSITY OF BRITISH COLUMBIA

Overwinter soil cover with silage tarps and cover crops

Soil water dynamics

Summary results from Too Much Water or Too Little?

Project context: Winter cover is important to protect soil from heavy fall and winter rainfall of South Coastal British Columbia (BC). Without the protection provided by annuals crops as in the growing season, bare soil is susceptible to nutrient leaching and erosion. Climate change and production constraints make cover crop establishment across an entire farm challenging. Fall crop production can interfere with cover crop planting dates or growers may want to reserve a portion of the field for early spring production. Increased precipitation in the shoulder seasons due to climate change create difficult soil conditions for establishing and terminating cover crops. Tillage is traditionally required to move production fields from cash crop to cover crop and back again. However, there are soil moisture thresholds above and below which tillage is particularly damaging to soil health. Increased precipitation that leads to wetter soils will likely shift the window of soil workability earlier in the fall and later in the spring, shortening the production season for growers. Tarping has emerged as a practice used by small-scale organic farms to help provide soil cover when cover cropping is not viable.

Project overview: The Too Much Water or Too Little? project was conducted by the Sustainable Agricultural Landscapes Lab at the University of British Columbia. In 2019-2021 this study investigated the impact of overwinter cover crops and silage tarps on soil water dynamics and other agronomic outcomes on 14 farms in 3 regions of BC: Lower Fraser Valley (LFV), Vancouver Island (VI), and Kootenay Mountains (KM).

Methods: A mother-daughter experimental design was used evaluate silage tarps and cover crops across a variety of climates and soil types. Twelve daughter farms hosted unreplicated trials and two mother farms (UBC, GRF) hosted replicated trials (n=16). Silage tarps were laid in the field in the Oct-Nov and removed mid-late April of the following year. On the mother farms, fall rye (Secale cereale; 4.45 kg ha-1) and crimson clover (Trifolium incarnatum; 0.75 kg ha-1) were seeded in mid-Oct. On the daughter farms, cover crops were not readily established and silage tarps were compared to a no-tarp plot which was cover cropped, bare fallowed, or mulched with crop residue.

Volumetric water content (VWC) was measured on the mother and daughter farms at the time of tarp removal at a depth of 0-8 cm. Cover crops had not been terminated at the time of measurement. VWC is defined as the ratio of the volume of water to a known volume of soil. VWC was measured using a FieldScout TDR 100 soil moisture probe in the field. At UBC, additional VWC measurements were taken every 2-3 weeks from November 2019 to October 2021.

Spring VWC results: Results from spring soil moisture content varied between trials and years (Figure 2). At UBC, VWC was greater in the tarp treatment than the cover crop treatment in 2020 but differences between overwinter treatments were not significantly different in 2021. The inverse was observed at GRF. Soil VWC was significantly greater under tarps compared to the no-tarp treatment at the daughter sites. Region and cover-region interaction were not significant in either year. The relationship between soil moisture and soil workability underlies its importance with respect to overwinter soil cover type. While optimum soil moisture for tillage is dependent on both soil texture and organic matter content, the results of this study show that the type of overwinter cover influences spring soil moisture.

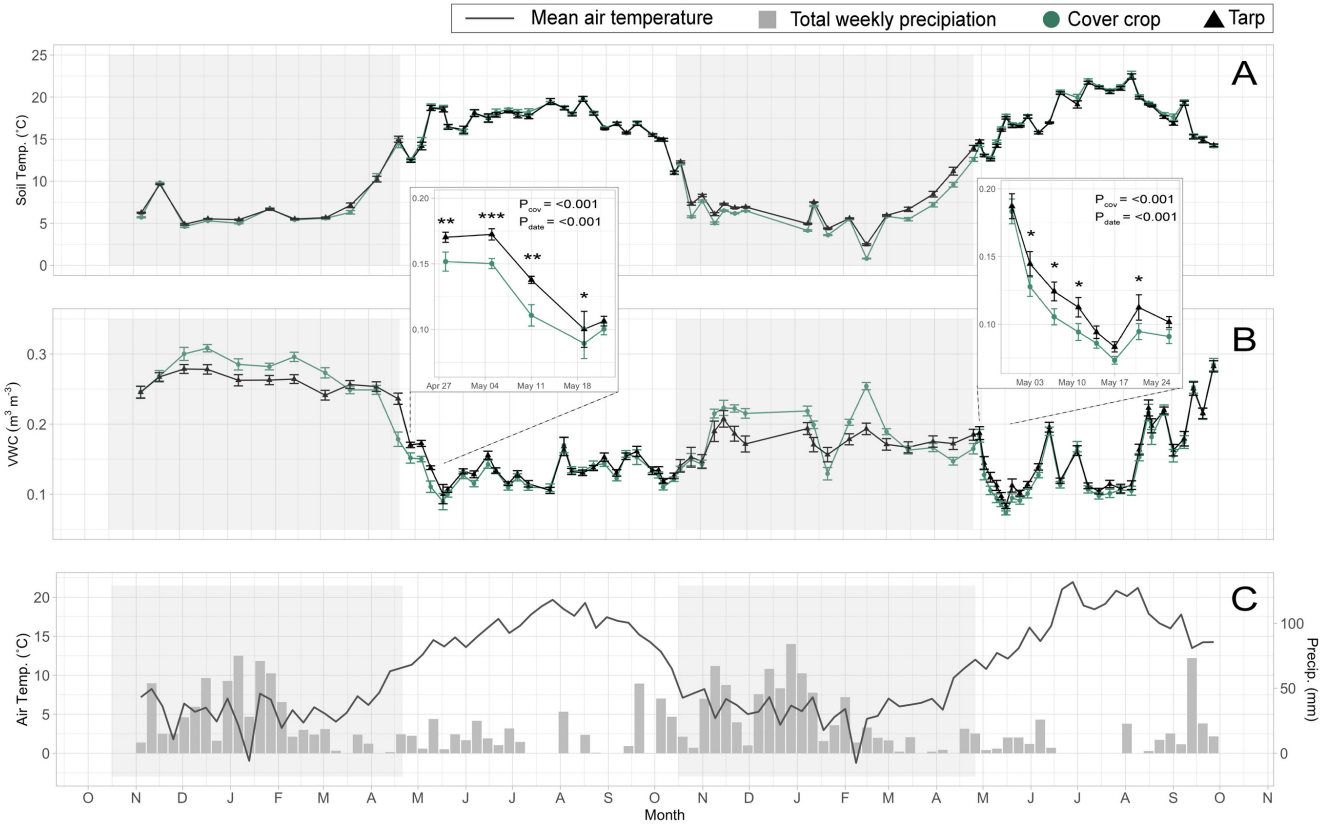

Figure 1. Soil temperature (A), volumetric water content (B) means ± one standard error by overwinter cover type (cover crop, tarp) at UBC Farm Feb-June 2020, 2021. Outsets show volumetric water content in the month after tarp removal. Average temperature and total precipitation (C). Time of tarp cover in the field indicated by shaded region. P-values determined by linear mixed-effect models show the significance of cover type (cov) treatment. Asterisks indicate level of significance: * (P<0.05), ** (P<0.01), *** (P<0.001).

Data from UBC Farm (Figure 1) indicates that relative VWC changes over the course of the winter and spring. From the time of tarp installation in the fall until early March, tarped plots were drier than the cover cropped plots. In mid-March of both years the cover crop started to dry out quicker than the tarped plots, which maintained a relatively constant VWC until tarp removal in the third week of April. This is likely because the tarps prevented evaporation while the cover crops began to grow in the warmer and longer days of early spring and released water via evapotranspiration. The previously tarped plots maintained a significantly higher VWC than the cover cropped plots for approximately 2-weeks after tarp removal. These data imply that the timing of tarp removal likely has important impacts on soil moisture. The ideal timing of tarp removal is dependent on the growers' goals and soil type. The results from both regional trial and UBC Farm indicate soil covered with tarps retained more water later into the spring relative to fallow or cover cropped ground.

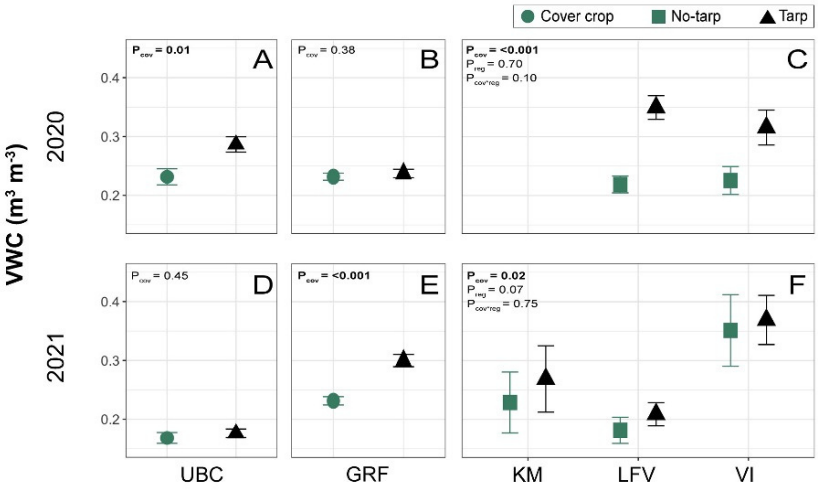

Figure 2. Volumetric water content means ± one standard error by overwinter cover type (cover crop, no-tarp, tarp). P-values determined by linear mixed-effect models show the significance of cover type (cov) treatment and/or region (reg) and their interactions. Significant findings (P<0.05) are shown in bold.

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For detailed results visit https://sal-lab.landfood.ubc.ca/