

Detection of winterkill events of white mustard (*Sinapis alba* L.) by satellite-based remote sensing

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Cover crop management mainly consists of sowing and termination, whose timing affects the agro-ecological services provided by cover crops. Thus, identifying the correct time windows is crucial for field management. Autumn-winter cover crops can be terminated by frost damage (winterkill termination) if they are exposed to sub-zero temperatures exceeding their frost tolerance. Assessing winterkill occurrence frequencies allows comparing scenarios of crop management options for farms or regions, thus supporting the informed choice of cover crop species and sowing dates. A few studies regarding cover crop species (*Sinapis alba* L. specifically) frost tolerance are reported in the literature and those present consisted of local indications. Satellite-based remote sensing is suited for the estimation of the effects of biotic and abiotic crop stressors from field to regional scales. However, a few studies addressed the monitoring of frost damage and none of them on cover crops. The study aimed to develop a relationship between seven different vegetation indices values and winterkill occurrence. A remote sensing monitoring campaign was carried out, using satellite images retrieved from Sentinel-2, during the 2021-2022 autumn-winter season in six commercial farm fields of the Lombardy region. Field measurements of aboveground biomass and visual assessment of frost damage symptoms were performed to validate satellite data. Significant ($p < 0.05$) relationships were detected between the ground-measured frost damage index and the vegetation indices (following She et al., 2015): EVI ($R^2 = 0.65$), MSR ($R^2 = 0.67$), NDRE ($R^2 = 0.57$). Furthermore, the procedure developed by Zhao et al. (2020) was adapted to identify the timeframes during which a decrease of the vegetation index value can be accounted for a frost damage event. The timeframes obtained through this procedure were consistent with field observation opening the possibility of using satellite images to support the field management of autumn-winter cover crops on a regional scale.