



## Use and Performance of Cover Crops for Enhanced Carbon Sequestration and GHG Mitigation in Croplands

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Traditionally cover crops have been used to reduce nitrogen leaching from croplands, although there is an increased realisation that they could contribute to an enhanced annual sequestration of carbon by providing vegetation cover during fallow periods. This will depend to a certain extent on the ability of the cover crop to photosynthesise during autumn/winter periods and, in turn, on the prevailing environmental conditions. A possible downside of the use of cover crops in terms of a full GHG balance is the potential losses associated with increases in trace gases such as nitrous oxide and methane due to alterations in soil physics or biogeochemistry and/or decomposition of material prior to crop growth in the spring. To address these issues we have examined the impact of a cover crop (mustard) on the GHG balance of a spring barley cropping system. We show that mustard can significantly improve the carbon balance but that this is constrained by freezing night temperatures, even under these mild climatic conditions, with a 27-54% reduction in photosynthetic performance, depending on year. The effect is dependent on the severity and duration of the freezing temperatures and was characterised by a slow recovery of photosynthetic performance after the freezing event. We also show that the cover crop has no impact on the losses of dissolved carbon. Preliminary results indicate that the cover crop does not significantly impact on trace gas emissions during autumn/winter, although there may be an effect during residue incorporation prior to tillage practices in the spring. Overall these results indicate the utility of using cover crops for GHG mitigation in arable agriculture and indicate that further research should be focussed on the choice of species for particular environmental conditions, including enhanced tolerance to, and recovery from, freezing night temperatures.