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Temporal soil organic carbon dynamics following land-use change for lignocellulosic bioenergy production

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As the demand for renewable energy crops increases to assist in reducing anthropogenic carbon dioxide (CO_2) emissions, the projected future expansion in bioenergy crop production is expected to cause significant land-use change (LUC). It has been reported that lignocellulosic crops such as Miscanthus and willow short rotation coppice (SRC) have the potential to mitigate CO_2 emissions through fossil fuel replacement and by soil organic carbon (SOC) accumulation following direct LUC. Many studies have been carried out with the purpose of measuring site-specific changes, however results are often mixed demonstrating both increasing and decreasing carbon (C) stocks over time. Such variation demonstrates the sensitivity of SOC to many factors such as climate, soil texture, previous land-use and initial SOC content. This study examined a chronosequence of $\sim$100 Miscanthus and willow plantations established on arable and grassland across Britain to provide an improved understanding of general effects on temporal SOC dynamics during LUC. Soil was sampled at each site to a depth of 30 cm and SOC stocks assessed over a 14 year time period. For each of the 4 LUCs no significant differences were observed between measured C stocks after 14 years and expected baseline values for land under arable and grassland management. Evidence will be presented that shows in all cases a 0% change lies within the 95% confidence intervals indicating no true average increase or decrease can be reported for the first 14 years of establishment. Therefore we find no evidence to suggest a short term CO_2 mitigation effect provided from SOC storage following the establishment of Miscanthus or willow on arable or grassland. However, longer term measurements are required to assess SOC dynamics beyond this initial period.