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Environmental sustainability of bioenergy crop cultivation represents an important challenge and is a topic of intensive scientific and political debate worldwide due to increasing societal needs for renewable energy. Despite the increasing knowledge related to potential bioenergy systems, the effect of land use change (LUC) on GHG fluxes during the conversion remains poorly understood but is likely to be substantial. In order to tackle this issue the Great lake Bioenergy Research Center (GLBRC) of the US Department of Energy (DOE) has established a field experiment and deployed a cluster of eddy-covariance towers to quantify the magnitude and changes of ecosystem carbon assimilation, loss, and balance during the conversion and establishment years in a permanent prairie and four types of candidate biofuel systems [Conservation Reserve Program (CRP) grassland, switchgrass, mixed-species restored prairie and corn]. Six sites were converted to soybean in 2009 before establishing the bioenergy systems in 2010 while one site was kept grassland as reference. Soil N2O and CH4 fluxes were measured biweekly with static chambers in four replicate locations in each fields, within the footprint of the eddy covariance tower using static chamber GHG flux protocols of the KBS LTER site. Our field observations, made between January 2009 through December 2010, showed that conversion of CRP to soybean induced net C emissions during the conversion year that ranging from 288 g C m-2, to 173 g C m-2 . while at the reference CRP grassland site net C balance were -42.9 and – 16.1 g C m-2 yr-1 in 2009 and 2010, respectively. N20 emissions were larger at the former grassland converted to bioenergy crops 12.3 (±3.4) N2O-N (g ha-1d-1 compare to unmanaged grassland 2.7 (±0.7) g ha-1d-1. CH4 emission were considerable lower and ranged from -0.7 (±0.4) CH4-C g ha-1d-1 at the sites converted to 0.8 (±1.8) CH4-C g ha-1d-1 at unmanaged grassland. The conversion of CRP lands has induced major $CO_2$ emission over the two-year study period that can take many years to recover. The cumulative C balance of the ecosystems in the years after the conversion was under the strong influence of the C lost during the conversion phase and the C balance of the new biofuel crops. The carbon lost during the conversion year cannot be detected by variations of SOC (the conversion phase is too short of a period) or by simply measuring the biomass production before and after the conversion. EC technique was able to detect short term C change necessary to evaluate C debt in converted biofuel systems. For better understanding the complex mechanisms that influence the C balance during the LUC, this study underlines the need to study the GHG fluxes during the conversion phases of permanent ecosystems (e.g., permanent grassland, forests, etc.) into agricultural or bioenergy crops.