



How does a land use change from annual food crop to perennial energy crop affect the CO₂ balance? A study on net ecosystem exchange of carbon dioxide from Danish fen peatland grown with spring barley and reed canary grass

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It is important to evaluate how land use change from annual arable food crop to perennial energy crop cultivation changes the carbon balance in cultivated peatland. We measured CO₂ balance in a riparian fen peatland used for growing reed canary grass (RCG) and spring barley (SB) on adjacent field plots for a complete year with a dynamic closed chamber. Carbon dioxide fluxes measured with chamber were divided into a light dependent part as gross photosynthesis (*GP*) and a light independent part as ecosystem respiration (*R_E*). *GP* and *R_E* in both cropping system showed a strong seasonal pattern with weather condition and vegetation. A high ecosystem respiration in RCG ($1532 \pm 32 \text{ g CO}_2\text{-C m}^{-2}$) and SB ($1080 \pm 32 \text{ g CO}_2\text{-C m}^{-2}$) during growing season was offset by higher gross photosynthesis in RCG ($-1782 \pm 53 \text{ g CO}_2\text{-C m}^{-2}$) and SB ($-1225 \pm 59 \text{ g CO}_2\text{-C m}^{-2}$) making both cropping system net sink of CO₂ during the growing season. The estimated gross photosynthesis in cold-season from October to March was 17% and 6% of annual GP in SB and RCG plots, respectively. This higher uptake of CO₂ during cold-season in SB plots was caused by growth of volunteer grass during winter which was completely suppressed in RCG plots due to its invasive nature. Both *GP* and *R_E* were significantly higher in RCG plots than SB plots in an annual scale but net ecosystem exchange was not significantly different. Total estimated annual ecosystem respirations were $1887 \pm 10 \text{ g CO}_2\text{-C m}^{-2}$ in RCG plots and $1288 \pm 12 \text{ g CO}_2\text{-C m}^{-2}$ in SB plots. Similarly, total estimated annual *GP* were $1885 \pm 100 \text{ g CO}_2\text{-C m}^{-2}$ in RCG plots and $1408 \pm 24 \text{ g CO}_2\text{-C m}^{-2}$ in SB plots making a net ecosystem exchange of $2 \pm 88 \text{ g CO}_2\text{-C m}^{-2}$ in RCG plots and $-120 \pm 25 \text{ g CO}_2\text{-C m}^{-2}$ in SB plots.