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# Characterisation of seasonal development of two main crops describing diurnal courses

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For a better understanding of the complex Soil-Vegetation-Atmosphere exchange processes, long-term monitoring and three dedicated campaigns were conducted in the frame of the collaborative research consortium Transregio TR32. In 2008 integrated measurements in a mainly agricultural dominated region within the Rur catchment (NRW, Germany) covered different vegetation types throughout the vegetation period.

This study concentrates on the temporal variations of plant mediated CO2 and H2O exchange processes. The close link between photosynthetic CO2 uptake and transpiration underscores the need to directly determine photosynthetic activity.

Seasonal development of the two main crops of the region, winter wheat and sugar beet, has been characterised during five diurnal courses using non invasive methods ranging from leaf to canopy level including gas exchange, PAM fluorometry and eddy correlation measurements. In both species, maximum quantum yield showed no variability independent of date and daytime. But the clear day course of photosynthetic capacity was constant during the day for winter wheat whereas sugar beet showed a constant decrease over the day. The maximum electron transport rate of sugar beet showed significant negative correlation to the non-photochemical quenching while no district pattern in winter wheat. The photosynthetic capacity in both species showed strong correlation to the leaf light reaction efficiency, but became weak when there was less stomatal conductance of leaves. The highest photosynthetic electron transport rates appeared before solar noon for all measurement days. This diurnal development in leaf-level measurements also represented highest CO2 fixation rates before solar noon that were also detected with the eddy covariance method. Our results of leaf and ecosystem level measurements both showed that environmental conditions especially incoming light caused this diurnal development of photosynthetic efficiency determining carbon and water fluxes.