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Diel patterns of rhizospheric, mycorrhizal and heterotrophic respiration, responses to drought and to plant CO_2 uptake in dry grasslands

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Diel variability of soil respiration could be driven by several factors, but temperature and carbon allocation have the most significant effect on that. However, these two factors covariate on multiple time scales, therefore it is not easy to disentangle their effect.
We measured CO_2 efflux in undisturbed, root-excluded and root- and mycorrhizal fungi excluded plots and analyzed the diel variability and the responses to GPP in different phenological stages. We used sine wave models to describe the characteristics of diel variability and to estimate the temperature and GPP driven part of total soil respiration.
Rhizospheric respiration peaked 8-12 hours after GPP peak, while mycorrhizal fungi respiration had a longer time lag of 13-20 hours. Results of isotopic measurements also showed similar pattern. Drought affected respiration rates as well as carbon allocation pattern; both the amount and the speed of carbon allocated to mycorrhizal fungi were reduced under drought.
Based on these results we assume that the commonly used Q10 values does not always reflect the temperature response of soil CO_2 efflux, but the propagated effect of the temperature and belowground carbon allocation and those share in soil respiration vary with phenological stages.