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Rotational and continuous grazing does not affect the total net ecosystem exchange of a pasture grazed by cattle but modifies CO_2 exchange dynamics

Louis Gourlez de la Motte, Yves Beckers, Bernard Bodson, Bernard Heinesch, and Marc Aubinet
University of Liege - Gembloux Agro-Bio Tech, TERRA research and teaching center, Belgium

Grassland carbon budgets are known to be greatly dependent on management. In particular, grazing is known to directly affect CO_2 exchange through consumption by plants, cattle respiration, natural fertilisation through excreta, and soil compaction. This study investigates the impact of two grazing methods on the net ecosystem exchange (NEE) dynamics and carbon balance, by measuring CO_2 fluxes using eddy covariance in two adjacent pastures located in southern Belgium during a complete grazing season. Rotational (RG) grazing consists of an alternation of rest periods and short high stock density grazing periods. Continuous grazing (CG) consists of uninterrupted grazing with variable stocking rates. To our knowledge, this is the first study to assess the impact of these grazing methods on total net ecosystem exchange and CO_2 exchange dynamics using eddy covariance. The results showed that NEE dynamics were greatly impacted by the grazing method. Following grazing events on the RG parcel, net CO_2 uptake on the RG parcel was reduced compared to the CG parcel. During the following rest periods, this phenomenon progressively shifted towards a higher assimilation for the RG treatment. This behaviour was attributed to sharp biomass changes in the RG treatment and therefore sharp changes in plant photosynthetic capacity. We found that differences in gross primary productivity at high radiation were strongly correlated to differences in standing biomass. In terms of carbon budgets, no significant difference was observed between the two treatments, neither in cumulative NEE, or in terms of estimated biomass production. The results of our study suggest that we should not expect major benefits in terms of CO_2 uptake from rotational grazing management when compared to continuous grazing management in intensively managed temperate pastures.