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N2O emission from plant surfaces – light stimulated and a global phenomenon.

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Nitrous oxide (N2O) is an important long-lived greenhouse gas and precursor of stratospheric ozone depleting mono-nitrogen oxides. The atmospheric concentration of N2O is persistently increasing; however, large uncertainties are associated with the distinct source strengths. Here we investigate for the first time N2O emission from terrestrial vegetation in response to natural solar ultra violet radiation. We conducted field site measurements to investigate N2O atmosphere exchange from grass vegetation exposed to solar irradiance with and without UV-screening. Further laboratory tests were conducted with a range of species to study the controls and possible loci of UV-induced N2O emission from plants. Plants released N2O in response to natural sunlight at rates of c. 20-50 nmol m-2 h-1, mostly due to the UV component. The emission rate is temperature dependent with a rather high activation energy indicative for an abiotic process. The prevailing zone for the N2O formation appears to be at the very surface of leaves. However, only c. 26% of the UV-induced N2O appears to originate from plant-N. Further, the process is dependent on atmospheric oxygen concentration. Our work demonstrates that ecosystem emission of the important greenhouse gas, N2O, may be up to c. 30% higher than hitherto assumed.

Literature:

Mikkelsen TN, Bruhn D & Ambus P. (2016). Solar UV Irradiation-Induced Production of Greenhouse Gases from Plant Surfaces: From Leaf to Earth. Progress in Botany, DOI 10.1007/124_2016_10.

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