Supplementary Material

Detailed information about the system and the principle of gas measurement in **2.2 Experimental design:**

2.2.2 Gas kinetics analysis

The system integrates an incubation and gas analysis subsystem, continuously monitoring the headspace air for the concentrations of O_2, CO_2, N_2O and N_2 at a predefined six-hour sampling interval. The headspace gas samples are automatically extracted and transported by a Gilson Model 222 peristaltic pump to an Agilent 7890A gas chromatograph, which is equipped with both an electron capture detector (ECD) and a thermal conductivity detector (TCD) for precise analysis. This entire sampling and analysis process is facilitated by a custom-designed Python computer program. To enure a constant pressure within the flasks during sampling, an equivalent volume of ultrapure helium (99.999% purity) is automatically injected back into the flasks immediately after each sampling event. The N_2O fluxes are then calculated based on the measured changes in N_2O concentrations within the headspace between successive sampling intervals, as outlined in the methodology by Cao et al. [54]. Furthermore, the gas emission rates are computed utilizing a methodology developed by the NMBU team at the Norwegian University of Life Sciences (https://www.nmbu.no/en/research/groups/nitrogen/approaches-and-infrastructure). It is important to note that all measurements and subsequent calculations reported in this study are based on the oven-dry soil mass, ensuring consistent and comparable results.

Reference

54. Cao, W.; Liu, S.; Qu, Z.; Song, H.; Qin, W.; Guo, J.; Chen, Q.; Lin, S.; Wang, J. Contribution and driving mechanism of N_2O emission bursts in a Chinese vegetable greenhouse after manure application and irrigation. *Sustainability* **2019**, *11*, 1624. https://doi.org/10.3390/su11061624