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Optimising N2O measures following the application of mineral and organic nitrogen fertiliser to sugarcane

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Agricultural soils are the most significant source of the major greenhouse gas N_2O (Reay et al. 2012). Sugarcane production has an important contribution to these emissions (Yang et al. 2021). There is limited information related to optimising N_2O emission measures, in particular for organic fertilisation, which could greatly reduce the cost and time spent in measures. Datasets from a highly instrumented experimental site in Reunion Island were analysed with the aim of minimising manual chamber N_2O emissions, while ensuring that reasonable accuracy of N_2O emission evaluations is maintained for the mineral fertiliser urea, and for two organic fertilisers, namely sewage sludge and pig slurry. Manual chambers remain the most accessible and widely used apparatus for N_2O emission measurements.

Continuous N_2O emissions were monitored over three sugarcane ratoons (between 2018 and 2021) using automatic chambers, and the data was interpolated to simulate manual sampling scenarios over the sugarcane growth-cycle, which was compared to daily N_2O emissions. Additionally, the number of measures required for each sampling over 60 minutes were tested using manual chambers, as well as the inter-row placement of chambers.

There was no significant difference ($p<0.01$) in emission values when 5, 4, 3 or 2 measures were taken over a 60-minute interval. The position of the manual chamber between sugarcane rows also did not have a significant impact. The sampling scenarios revealed that both bi-weekly sampling over the first 6 months of the ratoon, as well as 48 samples strategically placed over the ratoon relative to the emission patterns of each fertiliser type, were suitable for measuring N_2O emissions. These scenarios resulted in no extreme deviations from the daily measures for the urea and pig slurry fertilisers (< 10 % difference), and for sewage sludge (< 20 % difference).

The findings can be used to inform appropriate protocols to reduce cost and time spent in N_2O measurements without reducing the accuracy of N_2O emission results.

References

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