Fine-tuning the set-up of a photo-acoustic multigas analyser for gas monitoring in an open dairy barn

D’Urso Provvidenza Rita1, Arcidiacono Claudia 1\*, Cascone Giovanni1

1Department of Agriculture, Food and Environment (Di3A), Building and Land Engineering Section, University of Catania, via Santa Sofia 100, 95123 Catania, Italy

 \*Correspondence: provvidenza.durso@phd.unict.it;

phone:+390957147576; fax:+390957147605

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**Abstract.**

The estimation of emission rate of ammonia and greenhouse gases from livestock buildings requires measurements of gas concentrations. Research studies on how to collect data and obtain reliable measurements can optimise the strategy for gas monitoring in open and semi-open dairy houses.

Since the photo-acoustic spectroscopy system (INNOVA by LumaSense Technologies A/S, Denmark) is widely used for scientific purposes, especially in livestock building, the present study aims at improving knowledge on the measurement set-up of the instrument with in-field experiment. Measurements of gas concentrations (NH3, CH4, and CO2) at different sampling locations (SLs) and set-up were carried out in a semi-open dairy barn. Starting from a continuous monitoring of the gases, two datasets were selected to compute the error associated to different set-up of the instrument related to the Sample Integration Time (SIT) and the number of repetitions for each SLS. Then, the one-way analyses of variance were applied to assess significant differences for groups of data.

The results showed that the INNOVA set-up affected the measurement strategy as well as the localisation of sampling locations (SLs). In detail, the Sample Integration Time (SIT) set-up of INNOVA influences the duration of a measurement cycle by the device. Since there was not a significant difference between the errors on concentrations with SIT5 and SIT20 (P>0.05), the set-up with SIT5 is more suitable than SIT20 because it allowed to complete a measurement cycle in less than one hour with 12 SLs and 3 repetitions. The number of repetitions performed for each measurement had a significant influence on the design of the measurement campaign.