livestock farming, new scenarios are opening up. However, it is well known that these emissions are subject to significant variability, in particular, due to the individual production, the diet, the hour of sampling, and the cows' activity. Aim of this experiment was to study the enteric methane emissions during the automatic milking by a portable laser detector in dairy cows. 40 Italian Holstein dairy cows were enrolled for the trial (lact n° 2.07 ± 1.04, DIM 133 ± 65), they were tied in five groups of eight cows each and completely adapted to the tie stall area (one week). The DMI was monitored and TMR diet was kept constant. Cows were milked a specific time point 6 am (Morning), 2 pm (afternoon) and 10 pm (night). As the milking group was only 8 cows the maximum waiting period before the milking was 50 min. Methane was measured for each cow during the last 3 milkings before group change. The laser was pointed at the cow's muzzle during the whole milking and while the cow was eating the supplementary concentrate. Data was collected in ppm/m and transformed in grams/day. Statistical analysis was performed with a mixed model. Results shown a methane production of 94.21 ± 26.60 ppm/m (44.66 ± 7.32 gr) at 6 am, 110.89 ± 42.77 ppm/m (49.24 ± 11.76 gr) at 2 pm, and 9.82 ± 44.36 ppm/m (48.95 ± 12.20 gr) at 10 pm, ($p = 0.24$). A significant effect of the cow was found ($p = 0.05$). Average methane predicted was 314.92 ppm/m (142.85 gr/day), a lower value than what was expected (over 300 gr/day). This could be related to the time of measurement and the cow's activity (milking and eating the supplementary feed). To our knowledge no data are present in cows during these activities. It is also important to highlight that the inter-cows variability was greater than the inter-milkings/hour variability. We could suppose that cows during the milking time have quite constant methane production, with less interference related to fermentation pattern and/or rumination activity. We can conclude that the milking time could be used as a reference time point to measure methane emissions through portable devices. Future perspectives could evaluate the methane production during the milking in cows exposed to feed additives developed to reduce methane emissions.

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Predicting enteric methane emission of dairy sheep using milk fatty acid profiles

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The quantification of methane emissions by livestock plays a pivotal role in setting mitigation strategies in a scenario of climate change. Being the direct measurement of this phenotype expensive and difficult, several equations have been developed for its prediction. Milk fatty acids (FA) profile represents one promising proxy for the prediction of enteric methane (CH_4) in dairy species. To date and according to our best knowledge, no equations are available in literature for dairy sheep. The aim of this work was to estimate and evaluate the methane emission of dairy sheep using prediction equations originally developed for dairy cattle. Data of milk FA profile of 993 Sarda dairy ewes were used. The methane emission was estimated in terms of methane yield (MY, CH_4 g/kg DMI) and methane intensity (MI, CH_4 g/kg FPCM) using 9 equations developed for bovine milk: 6 for MY and 3 for MI. The correlations among the two estimated CH_4 values and milk composition and FA were analyzed. Mean values of MY obtained from the considered equations were very similar among them, ranging from 19.4 to 20.4 g/kg of DMI. Those of MI ranged from 15.1 to 21.0 g/kg of FPCM. Means values of MY and MI, obtained by the means of all considered equations per each animal, were 19.9 and 18.7, respectively, in agreement to previous reports on direct measurements in sheep. The value of MY corresponds to 9–10 kg of methane emitted per ewe per year, in agreement with the IPCC and other previous estimates. The methane emissions were positively correlated with milk fat and negatively with milk yield, and lactose. The methane emission was negatively correlated with short-chain FA with almost all the trans isomers of C18:1 and C18:2 (including isomers of conjugated linoleic acid, CLA), arising from the biohydrogenation of polyunsaturated FA (PUFA), and with several PUFA belonging to the n-3 family. Positive correlations were found with medium and long-chain saturated FA, with several odd and branched-chain FA, monounsaturated (cis isomers) FA, and some PUFAn-6. In conclusion, prediction equations for bovine can be advantageously used also in sheep. The pattern of correlations confirms the metabolic pathways shared by the enteric methane and milk FA and highlights a desired positive correlation between reduction of methane emission and increase of milk quality, in terms of beneficial FA concentration.

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Carbon footprint of intensive vs. extensive dairy farming in Gargano area

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Carbon footprint is an indicator of environmental sustainability quantifying the greenhouse gas (GHG) emissions generated by the individual or collective activities.

Two dairy farms located in Foggia province (CaseStudy1, CS1; CaseStudy2, CS2) both raising Mediterranean buffaloes (B) and crossbred Italian Friesian cows (C) with different management systems (intensive vs. extensive) were studied to investigate the impacts of milk production. Data about herd characteristics (live weights, mortality, fertility, production), diets composition, and manure management of dairy buffaloes ($n = 136$ vs. $n = 78$, CS1B and CS2B respectively) and dairy cows ($n = 44$ vs. $n = 31$, CS1C and CS2C respectively) were collected to evaluate the GHG emissions on a year basis according to FAO assessment model (GLEAM-i ver 1.9, https://www.fao.org/gleam/resources/en/).
Considering the global warming potential (GWP) of buffalo farms, the more extensive system in CS2B was found less impactful than the intensive CS1B, showing –33.7% of total GHG emissions (expressed as kg CO_2-eq/year) and –50.8% of total CH_4 (expressed as kg CH_4/year). Both feed intake (kg DM/year) and milk production (kg/year) were lower in CS2B (–48.3% and –52.7 % respectively), so that it resulted more impactful (+42.5%) when milk emission intensity (kg CO_2-eq/kg protein) was considered. The total N_2O emission (kg N_2O/year) was +56.7% in CS2B due to the different manure management.
Regarding the dairy cow farms, CS2C was found less impactful in terms of both total GHG and CH_4 (–21.1% and –37.5% respectively) emissions. Feed intake and milk production were lower in CS2C (–32.4% and –36.9% respectively), resulting the milk emission intensity higher (+25.8%) than in CS1C. Consistently with emissions in buffalo farms, the total N_2O emission was higher (+56.6%) in the extensive system.
Data processing suggested that GHG emissions were closely related to feed production practices, diet composition and manure management in the different farms. On this regard, formulating diets that match the nutritional animal requirements, improving feed digestibility and availability, introducing alternative protein source or by-product, and implementing manure and animal waste processing, could allow a more sustainable use of natural resources, limiting the potential negative environmental impacts while preserving farm remunerability.

O141

GIS model application for the assessment of nitrogen emissions from cattle

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In Tuscany, cattle farming has over 85 thousand heads at the end of 2020 and is part of a context of economic, environmental, and social sustainability. However, it is also involving emissions of climate-altering gases such as methane from enteric fermentation and nitrogen oxides, as well as nitrate leaching, which comes from manure management. Therefore, a Tier 2 method was applied to model nitrogen emissions within the Tuscan territory to estimate the environmental impact of cattle farming. The method used IPCC equations and georeferenced data adopting GIS software. The methodology started with the collection of the provincial data (National Livestock Register database) about the size, category, and age of the Tuscan bovine population. Subsequently, the energy and protein requirements in the ration for both, the dairy and beef category, were estimated by using CNCPS equations. Holstein and Limousine were the reference breeds for dairy and beef models, respectively. Basic assumptions were made in adopting coefficients recommended by the IPCC to estimate nitrogen losses of different manure management systems resulting from: (i) volatilization of ammonia and nitrogen oxides caused by fermentation during manure storage management; (ii) direct emission of nitrous oxide; (iii) nitrogen leaching during the storage of livestock waste. The results obtained, as an annual estimate of nitrogen losses, were georeferenced by province. The basic coefficients or assumptions of the model are estimated through the tables proposed for the Tier 2 method or the bibliographic search of variables for the characterization of a reference animal. The differences between the Tuscan provinces are considerable for all the parameters considered. For instance, N_2O emissions ranged from over 40% in the province of Grosseto to just over 0.1% in the province of Prato. This huge difference is proportional to the number of animals raised, mainly for meat, and to the surface area of the territory covered. The aspect related to nitrogen leaching is considered only as N that leaches into the soil or runs off during manure storage at feedlots or outdoor areas. The part of N leached at ground level as a result of field distribution is not covered by the model but managed by the nitrogen balance at the farm or territorial level. In conclusion, we note important differences within the Tuscan territory, to be evaluated through diversified sustainability indicators based on the variables considered.

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Predicted methane emission: a new breeding value for the Italian Holstein

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Livestock farming is indirectly linked to GHG emissions, mainly due to enteric fermentation. The livestock sector indirectly contributes to GHG emissions through activities related to feed production, manure spreading and storage, nitrogenous fertilizers, fossil fuels consumption and deforestation. Methane and carbon