Impact of animal density on predicted greenhouse gas emission on selected conventional, organic and grazing dairy farms in Wisconsin.

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Our objective was to test the impact of animal density (AD) on predicted greenhouse gas emission (PGE) in three Wisconsin farms with contrasting management systems. A combination of farm data and model-based predictions, using the Integrated Farm System Model, was used to derive PGE on 1 conventional (C), 1 organic (O) and 1 grazing (G) farm at 2 AD. The farms had a herd size of about 80 cows, 133 ha of forage land, and 0.6 cows/ha. At this low AD (LAD), the PGE were 0.53, 0.70 and 0.77 kg of PGE (CO2eq)/kg of milk for the C, O and G respectively and the main source of PGE was from housing facilities (47, 39, and 31% of total PGE on C, O and G, respectively). The indirect emission sources (manufacture or production of fuel, electricity, machinery, fertilizer, pesticide, and plastic) accounted for 21, 12, and 30% of PGE on C, O and G, respectively. Other important PGE sources at LAD were feed production on C (19%), and grazing on O and G (35 and 14%, respectively). Doubling the AD (HAD, 1.2 cows/ha of forage land) increased PGE by 22.9% on C, mainly due to 48% increase from indirect sources. The emissions from feed production and indirect sources increased by 38 and 29%, respectively on O, but the emission from grazing and housing facilities decreased by 5 and 1.3%, respectively, which led to a 6.4% net increase. Finally, PGE decreased by 3.1% on G as the net result of a decrease in emissions from manure storage and fuel consumption (41 and 20%, respectively) but 8% increase in indirect sources. These results demonstrated that the impact of AD on PGE was different on the 3 selected farms because of different farm management practices such as feeding, manure storage, and housing facilities. Although increasing AD might have a beneficial effect in reducing PGE per unit of milk on the selected G farm, results predicted a slight negative effect in the O farm and a more substantial negative effect on the C farm. Although the scope of the study is limited to the 3 selected farms, combining farm data with model-based predictions may be useful to study the changes in farm-level management practices on PGE.

Key words: Green house gas, IFSM, animal density.