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Improving feed efficiency in meat sheep increases CH<sub>4</sub> emissions measured indoor or at pasture.

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Ruminants are often criticized when it comes to environmental impacts, due to CH<sub>4</sub> production and to the part of concentrates in the diets. A major objective in breeding ruminants is to limit both feed-food competition and greenhouse gas (GHG) emissions. We divergently selected, over 4 generations, Romane meat sheep on their Residual Feed Intake (RFI) from 3 to 5 months old under a 100% concentrate diet. We present here two results of GHG measurements (performed with sheep GreenFeed, C-Lock) on males and females belonging to these divergent lines (animals were from the RFI- (efficient) or RFI+ (inefficient) line). A total of 124 males belonging to the 3<sup>rd</sup> and 4<sup>th</sup> generations of selection, bred indoor, had both GHG and forage intake measurements. On average, males weighed 64.6 kg and emitted 1345 g/d of CO<sub>2</sub> and 39.26 g/d of CH<sub>4</sub>. Positive correlations were estimated between CO<sub>2</sub> and CH<sub>4</sub> (0.59) and between gases and forage intake (0.24 for CH<sub>4</sub> and 0.54 for CO<sub>2</sub>) and body weight (0.38 for CH<sub>4</sub> and 0.78 for CO<sub>2</sub>). No significant differences were observed between RFI- and RFI+ males on body weight. RFI- males ate less forage than RFI+ ones (1.13 kg/d for RFI- and 1.22 kg/d for RFI+) but they emitted significantly more CH<sub>4</sub> (38.86 g/d for RFI- and 37.50g/d for RFI+), and less CO<sub>2</sub> (1326g/d for RFI- and 1335 g/d for RFI+). We confirmed this result with 85 ewes from the 4<sup>th</sup> generation of selection, first fed indoor with dry forage and then fed at pasture: RFI- ewes emitted significantly more CH<sub>4</sub> than RFI+ ewes, whatever the diet. GHG emissions were positively correlated between both diets (0.48 for CH<sub>4</sub> and 0.56 for CO<sub>2</sub>). Animal effects for GHG emissions, obtained from a repeatability model were significantly correlated under the two diets (from 0.66 for CH<sub>4</sub> to 0.78 for CO<sub>2</sub> intensity). Both studies highlight unfavourable relationship between feed efficiency and gas emissions: the more efficient animals ate less, but emitted more CH<sub>4</sub> than the less efficient ones. Moreover, phenotyping GHG indoor under a forage-based diet is of high interest when phenotyping GHG at pasture is not feasible.