

Soybean by-products reduce enteric methane emissions from dairy heifers

PATRICIA RICCI^{1,2}, LUCIA BURASCHI², GABRIELA VOLPI-LAGRECA¹, ALEJANDRA CUATRÍN¹, LAURA GUALDRÓN-DUARTE¹

¹National Institute of Agricultural Technology (INTA), Argentina; email: ricci.patricia@inta.gob.ar

²National Scientific and Technical Research Council (CONICET), Argentina

Corresponding author: ricci.patricia@inta.gob.ar

Acknowledgments: IAEA CRP 25103. INTA PD-L02-I097.

By-products from the cropping industry such as expellers or meals are used as protein sources. Changing from meal to expellers can modify the energy source of the diet due to higher lipids content compared with starch, thus reducing CH₄ and the use of grains. However, limited information exists to conclude about the impact of this feeding strategy. The aims of this study were to quantify the enteric methane mitigation potential and the replacement of grains for cattle supplementation. For this, two dietary treatments were offered once a day to 12 one-year-old Holstein heifers (240±11 kg LW). Diets were formulated to be isoproteic (150 g CP/kg DM) and isoenergetic (2.5 Mcal ME/kg DM), varying in the concentration of lipids and starch. Diets of both treatments had 60% (dry matter basis) whole-plant sorghum silage and 40% of concentrate. For the control diet (**CTRL**), concentrate had maize grain:soybean meal (40:60), whereas the alternative diet (**EXP**) had maize grain:soybean expeller (20:80). Treatments were tested in a crossover design, with two measurement periods. Heifers were transferred to individual pens at the methane measurement laboratory shed. Each period consisted of 14 days of acclimatization followed by 3 days of measurement. Dry matter intake (DMI) was measured by gravimetric difference of the offered and refused feed during the last 3 days of acclimatization and during the measurement days on chambers. Heifers entered individually to one of the two respiration chambers to measure enteric CH₄ emissions and DMI, continuing with the same feeding and pen cleaning routine. Heifers remained for 3 days inside the chambers and once the measurement finished, they were gradually fed the opposite dietary treatment for 14 days followed by the second measurement period. Chemical composition was determined on the offered and refused feeds and heifers live weight was recorded every 14 days with an electronic scale to monitor weight change and adjust the amount of feed offered. R Studio program with CrossCarry package and analysis of variance for crossover design were used for statistic analysis. No differences were observed on DMI (6.97 vs. 7.31 kg/d, 0.212 SEM, P=0.193), ME intake (17.6 vs. 17.8 Mcal/d, 0.462 SEM, P=0.454), and LW (285 vs. 282 kg, 3.86 SEM, P=0.82) of heifers fed EXP vs. CTRL diets, respectively. Heifers fed EXP had lower (P<0.0001) CH₄ production (159 vs. 191 g CH₄/day, 5.21 SEM), CH₄ intensity (0.559 vs. 0.675 g CH₄/kg LW, 0.014 SEM), and estimated Y_m (6.86 vs. 8.35 %, 0.217 SEM) than those fed the CTRL diet. These results could be explained by the higher intake of lipids (0.412 vs. 0.188 g EE/day, 0.007 SEM, P<0.0001) and lower intake of starch (0.702 vs. 1.049 g starch/day, 0.055 SEM, P<0.0001) of heifers fed EXP than CTRL diet. By replacing soybean meal by expeller in backgrounding diets, energy loss as enteric CH₄ was reduced by 18%, together with a decrease of the dependence on maize grain of 40%. Human non-edible food such as by-products from the cropping industry can reduce methane emissions without compromising food supply for human consumption.

Keywords: greenhouse gas mitigation, non-edible human food, beef backgrounding